Light *and* Lighting

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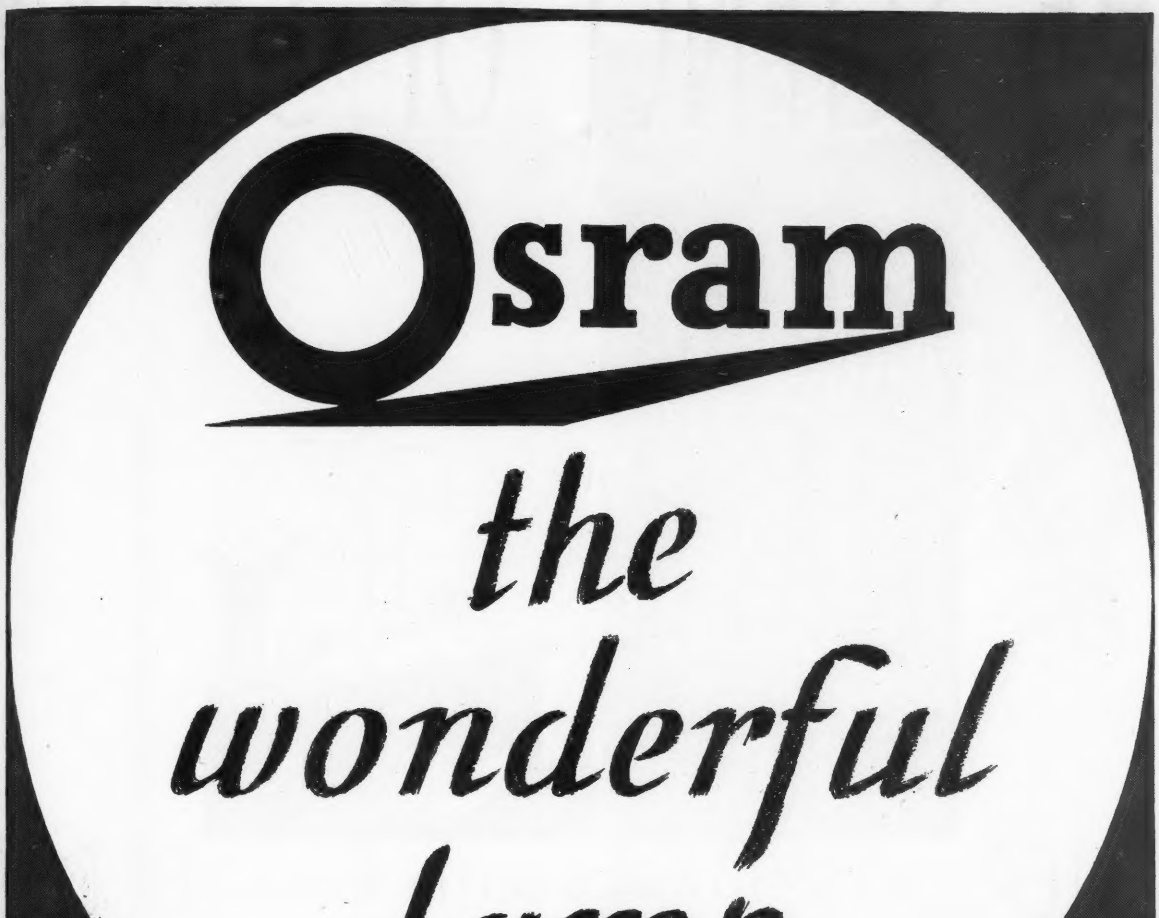
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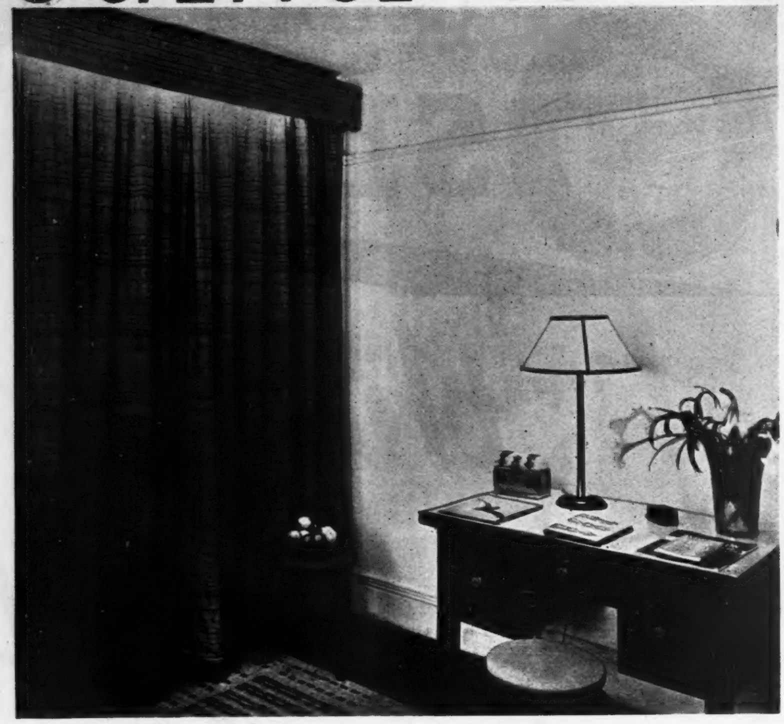

BETTER LIGHT

A STEP TOWARDS BETTER SEEING

BETTER SIGHT

The Study Lamp

The present level of illumination in the average living room, equipped with one central fitting, rarely exceeds 5 foot candles, while the illumination in other rooms is often below this standard. By means of local fittings, however, much better lighting can be provided for the more critical visual tasks, whether they occur in the home, the factory, or the office.

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Incorporating "The Illuminating Engineer."

Light and Lighting

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Principal Contents:

Two Things Public Lighting Authorities Should Do

THERE was Plenty of Good Advice given to Public Lighting Authorities at Cheltenham last month.

We pick out two hints, one given by the President of the A.P.L.E. (Mr. E. C. Lennox), the other also given by him and strongly endorsed by Alderman W. E. Wilford, of Leicester.

Firstly, then, Authorities should not enter into long term agreements with private companies or utility undertakings for street lighting—because lighting equipment is continually changing. The latest thing to-day is liable to become a back number to-morrow. Moreover, since they can borrow so cheaply, Authorities should own the lighting installations in their respective areas.

Secondly, it is ridiculous for Authorities to have to rely upon the engineers of gas or electricity undertakings (or the representatives of makers of lamps and fittings) for technical data. They should have their own separate Lighting Department with a competent lighting engineer in charge—all road lighting organisations should, as Alderman Wilford suggests, be independent and free of either gas or electricity undertakings. They should be in a position to make a wise and impartial decision.

The I.E.S. Session Commences—Public Lighting in Liverpool—The Johannesburg Empire Exhibition—Fatal Road Accidents—Window Displays as Eyes See Them—Lighting the Houses of Parliament, Cape Town—Industrial Lighting.

I.E.S. Session Commences

This month sees the opening once more of the Session of the Illuminating Engineering Society. At the opening meeting in London on October 13 the new President (Mr. A. Cunnington) will deliver his address, and the usual awards for papers will be made. The procedure initiated last year is again being followed, visitors being given the opportunity of a preliminary inspection of exhibits (more numerous than ever this year) at 4.30 p.m. Although, at the time of going to press, details of subsequent papers have not been issued, we understand that the programme includes contributions on industrial lighting, low voltage neon tubes, and the lighting of mines in the immediate future, and that other interesting topics are in store. The local circles, now three in number with headquarters in Manchester, Glasgow and Dublin, are also actively at work on the preparation of programmes, particulars of which will be available very shortly.

Public Lighting in Liverpool

The annual report of the City Lighting Engineer in Liverpool (Mr. P. J. Robinson) mentions several useful developments, notably in regard to the introduction of fittings minimising glare and the use of two units in each fitting so that the consumption can be halved after midnight without the distribution of light being affected. A striking item is the extended use of sodium lamps, of which 157 are now installed. The all-in running cost is stated to be 31-41 per cent. less than with the ordinary gas-filled incandescent lamp, which more than offsets the somewhat greater (25-35 per cent.) cost of installation. The relatively low brightness of the lamp is also an advantage. At the end of the report a table is introduced showing comparative results for 1893, 1903, 1913, and 1922-1926. Since 1893 the number of gas lamps has somewhat increased, from 12,802 to 16,280. The increase in electric lamps in use, however, has been continuous, 15,002 in 1935-6 as compared with *nil* in 1893. During this period the total candle-power has increased by 1,469 per cent., and the cost per candle per annum has decreased by 81.2 per cent., whilst the lighting rate (substantially constant for the last three years) has increased by 52.6 per cent. only.

The Johannesburg Empire Exhibition

We hear good reports of the vast Empire Exhibition in Johannesburg, at which many novel and spectacular lighting devices—including a massive rotating and illuminated " Globe of Empire " weighing twelve tons and a central " big light " visible 100 miles away —are to be seen. From all accounts the floodlighting of the stadium will also be of a very special character. Arrangements have been made for LIGHT AND LIGHTING to be specially represented at the Exhibition, and we hope to publish an illustrated description of the chief lighting features in due course.

Forthcoming Events.

Oct. 13th. Opening Meeting of the ILLUMINATING ENGINEERING SOCIETY; Presidential Address, Report of Progress and Exhibits *(E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, Strand, London, W.C.2)*. **4.30 p.m.,** preliminary **Inspection of Exhibits; 5.30 p.m., Meeting** and **Demonstrations.**

Similar Meetings have been provisionally fixed for local circles in Manchester (Oct. 20th) and Glasgow (Nov. 3rd).

Oct. 27th. Discussion on **"Statutory Regulations on Lighting; a Help or a Hindrance?** *(Informal Meeting of the Illuminating Engineering Society at St. Ermin's Hotel, Westminster, S.W.1)*; **6.30 p.m.**

To Visitors from Overseas

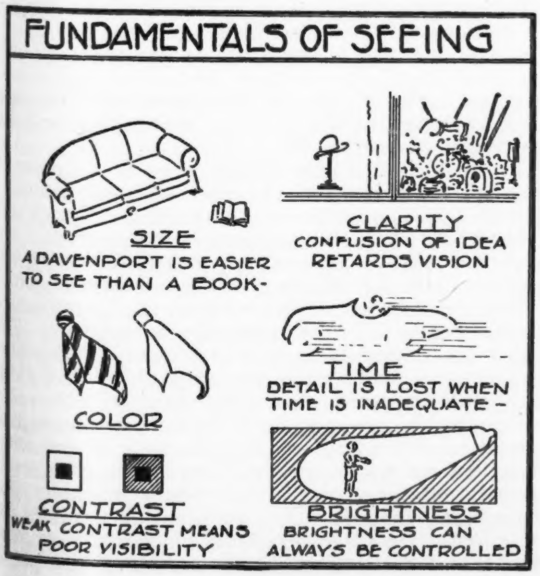
Already active preparations for the Coronation are being made. There will no doubt be present in London during the festivities many visitors interested in Lighting, including some who are members of the Illuminating Engineering Societies abroad—in the United States, in Australia, Japan, or the Continent. Should this note catch the eye of any such intending visitors we should be glad to hear from them, and to do what we can to put them in touch with others who share their interest in lighting during their stay.

Fatal Road Accidents

The recently issued M.O.T. Report on the above subject does not add very much to our knowledge on the relation between lighting conditions and accidents, but it goes some way towards confirming previous impressions. The effort previously made to classify accidents occurring during the hours of darkness, according to the quality of street lighting ("good" or "poor"), has been discontinued—no doubt, wisely, since no conclusion could be drawn unless corresponding data on the volume of traffic, etc., could be furnished. But accidents are still classified according to the hours of occurrence, and the inference is made that 58 per cent. occurred during the hours of daylight. That so high a percentage as the remainder (42 per cent.) should occur in darkness is significant when it is realised that, during a great part of the night, there is not only little vehicular traffic but an almost complete absence of pedestrians, most of whom are safe in bed. Instructive comparisons of accidents in different months at specified periods of the day may also be drawn. The conditions in built-up areas and during Mondays to Fridays are most typical of normal and continuous (rather than seasonal) conditions. If we take such periods as 9 a.m. to 11 a.m. or noon to 2 p.m., when there is always daylight, we find that the number of accidents in June and December is substantially the same. But if we take 4 p.m. to 6 p.m. we find the accidents *twice* as great in December as in June, and during 6 p.m. to 8 p.m. *nearly three times* as great—a change that can only be ascribed to the lack of daylight during the winter. Such data at least show that the change from daylight to artificial light in the streets does greatly increase the hazard, and that efforts to make the artificial lighting better, in the interests of safety, are well worth while.

Window Displays as Eyes See Them

Mr. Edward W. Hodgetts, who is associated with the Cincinnati Gas and Electric Company, has sent us a copy of an effective article under the above title, originally published in the United States but subsequently reprinted in "Display." "Seeing" consists of three elements, the eye, the task, and the display to be seen. Modern inventions are continually speeding up the buying public. Display windows stop, perhaps, 20 per cent. of pedestrians; 80 per cent. must see the goods displayed on the run. It takes only seven steps to pass the average window in an average time of three seconds. People do not make an effort to see a display—their attention must be captured. The conditions to be considered in judging the effectiveness of a display are Time, Clarity, Size, Colour, Contrast, and Brightness. Mr. Hodgetts suggests an ingenious form of scoring card for judging the contribution of these various items to a total visibility score of 100 per cent. The importance of time has already been indicated. Clarity includes neatness and selection—avoidance of overcrowding and confusion. Colour is a vital element. There is, the author suggests, a certain cowardice which restrains most of us from the use of vivid colour. If it is impractical to use colour in the goods or setting, colour-lighting may be applied. Contrast, again, is a most important element, perhaps the most vital of all in relation to "seeing." Finally, after everything has been done towards making a display visible there remains the question of achieving sufficient brightness—and it is here that the illuminating engineer steps in.



Lighting the Houses of Parliament, Capetown

[Courtesy: The General Electric Co., Ltd.

A view of the Union House of Assembly, Houses of Parliament, Capetown (S. Africa), where indirect lighting and sky-light illumination somewhat resembling that provided for the Mother of Parliaments in Westminster has been installed.

Industrial Lighting

In an article recently contributed to "Industrial Welfare," Mr. T. C. Angus, who is associated with the London School of Hygiene and Tropical Medicine, summarised the essentials of good lighting and quoted some statistics to illustrate its influence on production. Improved conditions have been found to result in increases in production varying from 6 per cent. for tile pressing (a purely mechanical process) up to 20 per cent. for knitting and weaving, and 24 per cent. for typesetting by hand. A recent report of the Department of Labour, Union of South Africa, emphasising the need for more efficient lighting methods and the desirability of a regular system of cleaning lamps and reflectors is quoted. Mr. Angus also pointed out the general desirability of diffused lighting from well-screened fittings and the drawbacks of unshaded filaments, which, besides being glaring, are apt to produce inconveniently sharp and deceptive shadows (though there *are* cases in industry where light coming from concentrated sources of light is preferable), and the evils of excessive contrast. He concluded by giving a short description of the now familiar "study lamp."

Light in Daily Life

(II) Light and Sight

The Effect of Near Work on the Eyes—Daylight and Artificial Light Compared—Methods of Seeing—Illumination Needed for Various Tasks—Importance of Contrast—The Evil of Glare—The Value of Shadows—The Eye and the Camera—The Need for Spectacles—Vision in Very Weak Light—Colours in Twilight.

Are our eyes *really* getting worse and worse? This is a question often asked, but, strange to say, difficult to answer with precision. It is doubtless a fact that the number of people, young and old, who wear glasses has increased steadily during the past fifty years, and possibly is still increasing. But we ought not to judge the prevalence of a defect only by the existence of the remedy!

It is only within quite recent times that convenient and accurate aids to sight have become available—and only more recently still that they have come within the reach of the multitude. Many of us can remember days when little care was given to the eyesight of school children. Earlier still, deficiencies of eyesight—unless so grave as to be obvious—were scarcely understood or recognised. Inability to see clearly was too often confused with lack of intelligence or natural perversity.

More definite statistics in regard to the eyes of school children, and of people engaged in various trades are now being acquired. It may, therefore, be easier for experts of the next generation to give a definite answer.

But, whether or no the eyesight of the present generation is worse than that of the preceding one, there is unfortunately little doubt on one point. It is the experience of most of us that our eyesight *does* tend to deteriorate throughout our span of life. The position in regard to children does give ground for concern. Whilst other powers, such as those of the mind and muscles, improve progressively, there is an evident tendency for the standard of vision to depreciate during school life. This continues in the adult. Many people, of course, escape lightly, but perfect sight in middle and later life is rare. (Was it not Bernard Shaw who once recalled the discovery of an oculist that he possessed "normal vision"—a condition so unusual and "abnormal" as to provoke surprise and comment!)

Another pointer is found in the statistics of those trades that impose unusual effort on the eyes. The percentage of visual defects is said to be high amongst compositors, and has been proved to be exceptionally so in the case of workers in the clothing and garment-making industries. Both these trades, it will be observed, involve sustained "close work" with the eyes. Allowance must be made for predisposition, yet it seems reasonable to suggest that it is mainly the way in which we use our eyes that occasions these lens-defects which are associated with too much "close work."

Effects of Near Work on the Eyes.

If it be true that our ancestors, besides rarely using glasses, rarely had need of them, an explanation is surely to be found in the conditions outlined in the previous chapter. One does not look for short sight in a man who cannot read. Our forefathers certainly read but seldom; those who did so habitually were "clerks," a race apart. To-day everybody reads. The eyes are applied in the sustained effort of close scrutiny instead of the leisurely intermittent and distant vision of outdoor life.

In the distant past information was conveyed mainly by word of mouth. But we have gradually become more and more accustomed to rely on the printed page for information and amusement. Not only do books form the chief means of study, but print occupies our leisure moments. Journeys, which formerly presented an opportunity for conversation, are devoted to the silent perusal of newspapers. The highly specialised industries of the present-day likewise involve near vision, as compared with the distant vision required in most occupations of the past.

Perhaps, fortunately, there does seem some sign of a retreat. If reading, as an amusement, is now somewhat less earnestly pursued, this is in part a revolt against unnatural conditions. New machinery for amusement and education, such as the wireless and the cinema, free the eyes from close vision to some extent, and the tendency to spend more time out of

10,000

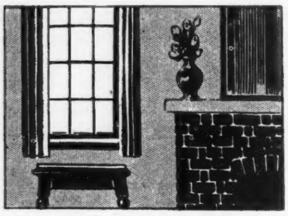
The sun on a clear day in June sheds 10,000 foot-candles on the earth below.

1,000

When the June sun is shining brightly the light in the shade of a tree is 1,000 foot-candles.

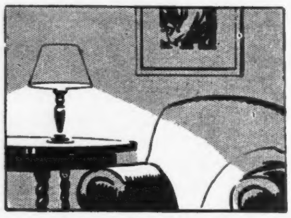
500

When the same June sun is shining the light in the shade of a porch is 500 foot-candles.



200

When the June sun is shining the light a few feet inside a window is 200 foot-candles.



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After the sun has gone down the light in the average living room is less than 5 foot-candles or 1/2000th of sunlight.

Courtesy: The E.L.M.A. Lighting Service Bureau

Diagrams illustrating the enormous range of Brightness in Natural and Artificial Light, from 5 to 10,000 foot-candles (a "foot-candle" may be roughly defined as the illumination produced by a source of one candle-power at a distance of one foot.)

doors and less in rooms operates in the same direction.

Blame for visual defects is placed on the increasing use of artificial light. Not only, it is declared, do we use our eyes too persistently for close work, but we now do so for long periods by artificial light, which is rarely to be compared with daylight, either in quality or quantity. For many thousands of years the human eye has been developed for the use of natural light. Can we wonder if it suffers when we subject it to utterly different conditions?

Until about fifty years ago there was not, perhaps, a great deal that could be urged in support of this argument. Illuminants were still primitive, the habit of reading had not become engrained, not a great deal of serious work was done by artificial light. But the advance in artificial lighting has encouraged mankind to turn night into day on a scale hardly visualised by our forefathers. Not only is regular work done in offices and factories for quite considerable periods by artificial light, but the hours of darkness are devoted to recreation much more freely. We do, in fact, spend a much larger proportion of our waking hours in artificial light than we used to do.

Daylight and Artificial Light Compared.

It may be well to inquire, therefore, what are the chief respects in which artificial light differs from natural light. Before entering on this analysis it may perhaps be well to correct one supposition. It is still sometimes assumed, quite erroneously, that there is some radical difference *in kind* between natural and artificial light, that the latter contains mysterious ingredients or noxious " rays " which are positively injurious to the eyes. Actually the composition of the approximately white light yielded by incandescent gas mantles and electric filament lamps has been closely studied by scientists. It contains nothing mysterious and resembles daylight much more closely than might be supposed. In the case of the recently introduced electric discharge lamps the difference in quality is certainly more marked; but even in this case there is no reason to suppose that the quality of light has injurious effects—indeed, as will be seen, it has for certain uses, apparent advantages.

What, then, are the chief differences between natural and artificial light? In order of importance they are: (1) intensity, (2) constancy, (3) diffusion, and (4) colour.

The illustrations which head this article give some idea how enormously daylight values exceed those customary by artificial light. If full daylight be taken as 10,000, the illumination on a table in an artificially lighted room may be 5 (i.e., 1-2000th), or less.

Against this, however, it must be noted that daylight is very variable. It undergoes tremendous variations, according to the time of day, the season, and climatic conditions, whereas artificial light can be maintained substantially constant. Nature has provided the eye with the power of accommodating itself (by alteration of the pupil aperture and by retinal changes) to these large variations. This helps to explain how, in the case of simple tasks, the eye can apparently often see as well in daylight as by the much lower illumination available at night.

Besides fluctuating with time, daylight inside buildings varies greatly with position. At the back of a room the light may well be 1-20th or even 1-100th of what it is on the window-sill. Therefore, when it is argued that the eye is accustomed to the high and uniform natural illumination available out of doors it is well to remember that *indoors* daylight is very far from even, and, in some parts of a room, often inadequate. Architects, in fact, have to take great pains to secure sufficient admission of daylight into the buildings they design.

Besides its high intensity a valuable quality of daylight is its diffusion. Coming as it does from the vast expanse of sky overhead, itself of moderate brightness, the light is " soft." There is no glare, and shadows are inappreciable.

Of the colour we have already spoken. There are those who consider that clearer vision is secured by exact imitation of the colour of daylight, whilst others go further, and suggest that for very close work accentuation of the green and blue regions of the spectrum is advantageous. It has been pointed out that the eye-lens, unlike the lens of an expensive camera, is not achromatic, i.e., it cannot simultaneously focus light from the red and blue ends of the spectrum. Imperfectly focussed light tends to produce a fuzzy image. Therefore, a clearer image may be produced by using monochromatic light, such as blue or green light for close vision. This question is still being explored, but for the normal eye and for tasks of a simple character the possible advantage does not seem to be very great.

It should be noted, however, that there is no quality of daylight that we cannot secure from artificial light if we so desire and if economic considerations can be disregarded. When the area to be illuminated is small, and the expenditure, therefore, moderate, we can actually improve on daylight, for artificial light, unlike natural light, is completely under our control.

How much light, then, does the eye really need? Broadly speaking, as much as it can get—provided that the light is properly applied, free from glare and other defects. In saying this, be it noted, we are speaking of the illumination on the object which we are examining, e.g., the page of a book, a picture, or the stage of a theatre—not of light scattered by surroundings or reaching the eye direct from the source.

Methods of " Seeing."

In order to understand the demand for illumination on a scale similar to that furnished by daylight it may be well to recall some of the factors involved in " seeing." The most simple operation is the recognition of outline, such as is furnished by black type on white paper, or the outline of hills or trees against the sky. In the case of such vision by silhouette we may find that, provided the objects are large and easy to see, and the contrast between object and background relatively high, no great gain is secured by increasing the light beyond a moderate value.

Other operations, however, depend on recognition of the form and solidity of an object, on detecting, for example, whether it is a flat disc or a round ball, and on the perception of light and shade. In general this more complex form of perception demands more light.

Other factors determining the amount of necessary illumination are the speed with which we wish to carry out our inspection, the emphasis desirable in order to make something " stand out " and command attention, and the increased effort involved in following an object in motion, as compared with one at rest.

Experiments have shown that all the powers of the eye called into play in these varied operations tend to improve steadily as the illumination is increased. It is true that in nature brightnesses *are* found so great as to prove detrimental to clear vision. The intense glare of the sun on a snowfield, or the reflection on the surface of the sea, is uncomfortable to gaze upon. An object on the snow or on the sea under these conditions may be completely masked by the surrounding glare. Illuminations high enough to produce such a brightness as this are, however, hardly likely to be attained by artificial light.

Illumination Needed for Various Tasks.

The advantage to be gained by higher illuminations, in making seeing easier, thus depends upon the task which the eye is asked to perform. In order to see our way about in a room or corridor we need only a little light, somewhat more for handling large objects, and considerably more when the things we are examining are small.

Another most important consideration is the *nature* of the object and its background, i.e., whether light

or dark in texture. If the object is itself dark its brightness may be small even if the illumination is high, and if background and object are identical the latter becomes most difficult to see even at the highest illumination. There is all the difference between type on good white paper and large and small and crabbed letterson stained and dirty parchment; in examining white flannel (which may reflect 80 per cent. of light) and black velvet (which may reflect 1 per cent. or less). Other considerations which determine our need for light are the degree of concentrated attention which we have to bring to bear on our task and the speed with which it must be accomplished. Casual glancing at a magazine is a very different thing from sustained study of matter difficult to follow, and from the vigilant and yet rapid examination of proofs for printer's errors. The light must be varied accordingly. The same applies to industrial processes, where both speed and accuracy may be necessary and the objects handled may be minute.

Since in practice a balance with economic considerations must always be struck, it is important to devise some scientific method of judging the requirements of different tasks. The Illuminating Engineering Society has recently been occupied with a method of weighing all the factors mentioned above and has issued "Recommended Values of Illumination" which serve as a guide to good lighting practice. Seven grades of operations are enumerated, the lowest, involving only casual observation, calling for only 2-4 foot-candles, the highest involving precision work of a high degree of accuracy, 50 foot-candles or more.

In the case of certain industrial processes—such as spinning and weaving and the setting of type by hand—it has been shown that illumination on the work approaching that derived from daylight indoors results in higher output and better quality of work. It is more difficult to prove that sustained work in a poor light causes deterioration of eyesight, as the effect is often gradual and may only reveal itself fully in later years. We can hardly be doubted, however, that such conditions are, in the long run, prejudicial to vision, and that the increased physical strain arising from inability to see with ease and comfort does in time react on the general health of the worker. The fact that much of the work of to-day is carried out at far higher speeds than those customary in a more leisurely past, in itself goes far to explain the craving for greater brightness.

In every field of life, however, we need sufficiency of light. It is not merely a question of providing sufficient illumination for people to read, sew, and knit, or perform work in a factory. It has been brought home to us during recent years that inability on the part of drivers and pedestrians to see clearly is responsible for many accidents in the streets by night. Even the recreations and entertainments of to-day demand light on a greater scale. In all processes involving the observation of rapidly moving objects, the need for light is accentuated On an artificially lighted tennis court, the course of the ball simply cannot be followed by players unless illumination of a relatively high order is provided. The same applies to racing tracks and games (such as football) played before spectators in artificial lighting—an innovation which involves lighting problems still imperfectly solved.

The Importance of Contrast.

So far we have regarded this question mainly in relation to the problem of getting *sufficient brightness* of the object viewed. But is is evident that there is another factor quite as important to visibility, namely, the provision of sufficient contrast between an object and its background.

A little thought will show that if an object has exactly the same colour and brightness as its background, it becomes invisible—a fact occasionally utilised by conjurers, and (it is said) by certain wild creatures, which gradually assume the same tint as their surroundings, and thus escape observation by enemies.

It is easy to read black type on a white background, but much less easy to do so if the printing is done on dark material and the contrast is less. In the same way sewing with black cotton on white cloth (or vice versa) is a very much easier process than when cotton and material have almost exactly the same colour.

Most tasks resolve themselves into the rapid recognition of relatively small things by the aid of the contrast with their immediate background. The "work" which we thus inspect may occupy a relatively small space, and the ill degree of illumination we need on this area depends largely on the reflecting power of the materials which we are using and the amount of contrast involved.

But what of the further background—not the background to the type on the printed page or to objects within the small working area, but the more *distant surround* which forms a background to the work as a whole? There is one good rule on this point. *The objects in the working area should be the brightest thing in the field of view*—in other words, the background should be a little (but not much) darker than the working area. If the distant background is lost in complete obscurity, whereas the work is brilliantly illuminated, the eye is called upon to adjust itself every time it strays from the work to the surroundings. In course of time this constant adjustment becomes fatiguing. Moreover, scientific tests have shown that the powers of perception of the eye are diminished—these powers are at their very best when a moderate contrast is furnished, in the manner recommended above. Fortunately, the conditions are easily met. Strong local lighting on the work, supplemented by subdued illumination of surroundings, is now regarded as the right method for all tasks involving somewhat severe effort.

This suggestion has other applications. The theatre deserves credit for its instinctive appreciation of expediency of concentrating light on the play and screening it from the eyes of the audience. With the relatively feeble illuminants of the past this was doubtless the natural course and the fact of the audience being in darkness heightened the illusion. It may well be suggested, however, that with the brilliantly lit stages of to-day, subdued lighting of the auditorium would often be an advantage, relieving a somewhat excessive contrast and enabling the eye to function more under natural conditions. The suggestion applies more definitely to the cinema. Subdued lighting of the auditorium might often be provided with prejudice to the appearance of the picture and with decided benefit to the eyes of the audience and the attendants.

To recapitulate. Small objects are seen mainly by aid of the contrast with their immediate background. The distant background should be somewhat (but not much, say 25 to 50 per cent.) less bright than the area on which our attention is concentrated. Whilst it is believed that for the best conditions of seeing the distant background should be less bright than the objects viewed, there is some room for difference of opinion how much darker it should be. But it is quite certain that the background should never be *brighter* than the area on which attention is concentrated. This "reversed contrast" inevitably interferes with vision, and if severe, may make the recognition of small differencs in light and shade impossible. It is only necessary for example to recall how difficult it is to distinguish objects within the mouth of a tunnel when one is looking into the gloom with a surround of bright sunlight; how difficult the recognition of a person's features becomes when one looks at his face with a strong light behind it.

These are examples of severe reversed contrast, but less evident instances very apt to occur in practice. A familiar example is the case of a factory

concerned exclusively with work on dark material, such as black cloth or boot leather. To flood the room with light, making good use of reflection from light walls and ceilings, which might serve excellently for many operations does not answer here, for the light surround becomes so much brighter than the working material that the latter appears underlighted. In such cases strong local lighting, so as to bring the brightness of the working material up to a figure beyond that of the surroundings, is essential.

The Evil of Glare.

When the sources oi light themselves come within the range of vision, so as to form a background to the things we are trying to see, the reversed contrast takes an acute form and we get the condition generally described as "glare." Perhaps the most outstanding example of glare is the strong dazzle from a motor car headlight on a dark road, the effect of which is momentarily paralysing to vision. But there are few modern sources of light which can be stared at without discomfort. In these days it may be taken as axiomatic that lamps and mantles should either be screened by opaque reflectors or surrounded by diffusing material which reduces their brightness to a value approximating to that of the white sky. This condition is easy to fulfil and is in fact satisfied by most well designed fittings utilising diffusing glass. Even sources thus screened should not, however, come within the direct range of view; for their brightness, even if relatively low, still exceeds that of the illuminated objects and their presence in the field of vision may give rise to reversed contrasts and in some degree impair perception by the eye.

The expediency of avoiding anything in the nature of dazzle is becoming every day more widely recognised, so that the use of indirect lighting and of large luminous surfaces of low brilliancy is general in modern schemes of interior lighting. In the case of streets and large outdoor areas it is less easy to eliminate glare; nevertheless, its drawbacks are acutely realised and efforts to achieve more moderate brilliancy are being made.

The Value of Shadows.

Another quality of lighting, apart from intensity, of great importance to seeing is the degree of diffusion. In most cases an object requires to be illuminated from a number of different directions, so that its shape and features may be properly distinguished. As a rule, it is a great drawback if light strikes an object from one direction only, as happens if it is lighted only by one single source of small dimensions. Much better effects are obtained if light is received from a number of sources, each enclosed in a diffusing globe or bowl, or by reflection from light coloured surfaces, such as walls and ceilings. Under these conditions the shadows are soft. We should not, however, go to the other extreme of producing *too* completely diffused illumination, such as might be derived from indirect lighting of a white ceiling in a room with white walls. The absence of evident shadow in such circumstances may give rise to flatness of effect, causing the form of objects to become less evident, and may thus act as a hindrance instead of an aid to visibility. Very sharp shadows, such as are caused by light coming from one direction only, are not usually desirable. There are, however, certain cases as, for example, in searching for spots, pits, or scratches on a highly polished surface, or in examining corrugated and engraved surfaces where we require just this form of lighting in order to show up clearly what we desire to see.

The Eye and the Camera.

In all these speculations on the needs of the eye we must bear in mind the nature of this organ, and the limitations to its powers, which differ greatly in individuals. Without entering too deeply into the structure of the eye one may recall its general resemblance to a photographic camera, with the important distinction that the lens, the pupil aperture (analogous to the "stop" on a camera lens) and the retina (the action of which may be likened to that of a photographic plate) — are all capable of automatic response to the conditions imposed upon them. The eye-lens can be so shaped by the muscles controlling it that the images of either near or distant objects can be focused on the sensitive layer of the retina.

As we have seen defects of the eye, mainly associated with the range or power of focusing of the lens, tend to increase throughout life. This, no doubt, explains why elderly people so often demand an exceptionally bright light (in some cases going so far as to demand an exposed light within the direct range of vision, in spite of the glare thus caused). Exposure of the eye to this brightness causes the pupil aperture to contract, thus "stopping down" the lens in the same manner as in a camera, and giving sharper definition.

Spectacles Needed Besides Good Lighting.

It must, however be remembered that whilst good lighting will enable the eye to make the best effort of which it is capable, it cannot counteract inherent defects, such as can only be remedied by the use of spectacles. In other words, if the eye is unable to form a clear image of an object at a given distance no amount of light will enable it to do so. Lens defects must therefore first be corrected by the oculist before the lighting engineer can do his part. For certain forms of fine work, which impose constant scrutiny of small objects at close quarters, magnifying glasses are helpful even to those with normal vision.

The guiding principle in lighting should be to enable the eye to work with the least effort. We should not, therefore, abuse its wonderful powers of adaptation. Whenever changes in brightness occur we should see that the transition is gradual, and that the eye is not constantly called upon to adjust itself to new conditions—a process which, if often repeated, is bound to cause eyestrain and fatigue.

Vision in Very Weak Light.

Throughout this chapter it has been assumed that we are concerned with vision by relatively bright light. There are occasions, however, when we have to manage with illuminations enormously weaker than those provided even by reasonably good artificial light. In all but the most brightly lighted streets, for example, there are areas where the illumination is far below what is necessary for comfortable vision. The same applies to coal mines, where, owing to special circumstances, ordinary methods of lighting cannot be applied.

When we have to rely on the natural light as found after sunset, the eye is working under very peculiar conditions. The full illumination from moonlight, for example, is only 1-500,000th of that available in full daylight and only 1-500th of that now usual in interiors receiving generous artificial light. The illumination from the stars and the night sky is, of course, very much less still.

It is a tribute to the marvellous powers of adaptation of the eye that we can, more or less, manage with a range of illuminations exceeding 1 to 1,000,000. Nevertheless, the night-adapted eye is in a condition very different from that prevailing by day. The pupil aperture is usually opened to the utmost and the retina assumes its most sensitive condition in order to get the full benefit of the low order of brightness prevailing. An object, of a brightness inappreciable by day, may therefore appear intensely glaring. In a dark lane by night the light of a match may be sufficient to cause dazzling of the eye for some minutes. Street lamps, which may appear distressingly bright to the eyes by night, become inconspicuous objects if left burning in the day time. This power of adaptation of the eye should

always be borne in mind in dealing with artificial lighting. The eye can adjust itself to the most varied conditions if it is given time. But a sudden transition from darkness to brightness or vice versa occasions shock and temporarily impairs its powers of perception. Attention has been drawn to the desirability of grading public lighting so that the change in passing from a dimly-lighted side street to a brightly-lit main street may be rendered gradual. Similar practice has been followed in connection with subways and tunnels, with a view to preventing dazzle when one emerges from underground into bright daylight.

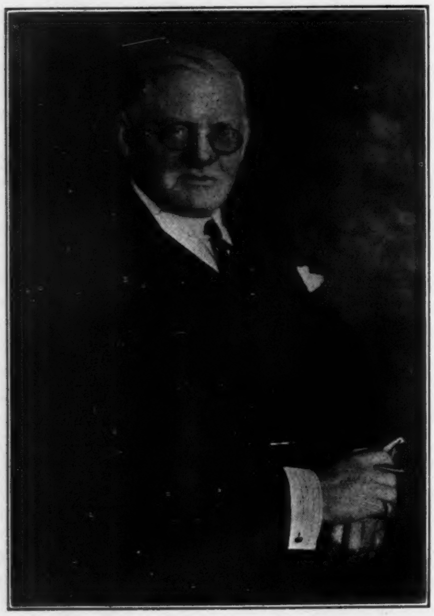
Colours in Twilight.

In other respects the night-adapted eye is in a peculiar condition. Whereas by daylight a small central region of the eye (the fovea) is the most sensitive, in faint light or darkness vision is accomplished mainly by the surrounding outer region. Distant faint lights can thus be seen "out of the tail of the eye" when indistinguishable to direct vision. At such weak illuminations the powers of the eye, both as regards perception of outline and degrees of contrast are much reduced. In one other respect—the perception of colour—the change is most singular. As the light fades the perception of red fades away much more quickly than the perception of green and blue. Ultimately the sense of colour disappears. In no way can this change be better demonstrated than by watching a bed of geraniums in fading daylight. In sunshine the bright red blooms are much more conspicuous than the green leaves. This contrast is accentuated if one retreats and views the bed from a distance, so that the image falls within the central region of the retina. In the twilight, however, the green leaves soon become the brighter. Finally, if the light is very weak and the eye is brought quite near (so that the outer region of the retina is used) the red flowers are found to have become jet black, whilst the leaves, though very much brighter, appear a ghostly grey. Such phenomena are naturally of considerable interest to lighting experts when they have to deal with weak illumination furnished by highly coloured sources of light.

Personal Notes

Sir Francis Goodenough's Retirement from the B.C.G.A.

Following the annual conference of the British Commercial Gas Association during October 3-6, Sir Francis Goodenough is retiring from the position of executive chairman, which he has held since the inauguration of the association twenty-five years ago. Prior to 1931, Sir Francis held the position of Controller of Gas Sales at the Gas Light and Coke Company, whose service he entered as a boy in 1888. He is still keenly interested in education, to which he devoted much effort, especially on the commercial and industrial side, and has given not a little of his scanty leisure to working for social and charitable objects. To readers of this journal Sir Francis is also known as a past-president of the Illuminating Engineering Society, in which he took a keen and active interest from its very early stages.



Mr. W. E. Bush Returns to London

Mr. W. E. Bush, well known to many of our readers as a member of the Illuminating Engineering Society of long standing and as an enthusiast for better lighting (he has been described as "Burning Bush," partly, doubtless, in allusion to his burning eloquence on this subject, and partly for his high-speed lecture tours throughout the country), is now managing director of the Curtis Lighting Company of Great Britain, Ltd., with headquarters at Aldwych House. Mr. Bush was originally associated with the British Thomson-Houston Co., Ltd. From 1924 onwards, he was active in developing the propaganda for better illumination and the illumination design courses of the E.L.M.A. Lighting Service Bureau. In 1928 he transferred his attention to the European business of the Curtis Lighting, and became managing director of the various companies which he established in France and Belgium. He is, as stated above, now devoting himself to the development of the business in Great Britain.

Mr. S. G. Hibben Demonstrates in Washington

Mr. S. G. Hibben, whose address to the Illuminating Engineering Society in London in 1934 is still remembered with pleasure, recently staged an interesting exhibit of "Better Light—Better Sight" fundamentals at the Third World Power Conference in Washington. Numerous attractive exhibits arranged by the committee under his chairmanship were much admired by guests and delegates at the Hotel Mayflower.

Obituary

SAMUEL B. CHANDLER.

We record with regret the recent death of Mr. Samuel B. Chandler, Distribution Superintendent of the Tottenham and District Gas Company, who was a leading figure in the gas industry and an enthusiast for education and training. For some years he was President of the Southern District Junior Gas Association, and at one time he was a member of the Illuminating Engineering Society. All those who came in touch with him will recall his genial nature and kindly disposition.

Special Problems in Industrial Lighting*

by R. O. ACKERLEY

(Illuminating Engineering Department of the General Electric Co. Ltd.)

THE principles governing the arrangement of general lighting in factories have been fully discussed in this journal and elsewhere, and are to-day gaining ever wider recognition and application in industry. There are few industries, if any, where the installation of first class general lighting fails to result in improvement in quality and output of product and general well-being of operatives, but it would be foolish to suggest that good general lighting is a cure for all lighting ills.

In almost every industry there are certain processes of manufacture or inspection which call for specialised methods of lighting, if the best possible results are to be obtained, and it is the object of this article to examine in general terms the nature of such problems.

Co-operation between Factory Manager and Lighting Expert.

In the first place it should be emphasised that, while somewhat similar special problems may crop up in several different industries, and the solution of a problem in one factory may help towards the solution of a very similar problem in another, they must in the first instance be treated strictly on their merits. This calls for very close co-operation between the factory manager or engineer and the lighting specialist, as only by this means can the latter find out exactly what is required. Obviously, no illuminating engineer can be expected to have an intimate and expert knowledge of all the special processes in every other industry, any more than the expert paper maker or dyer or motor-car maker can be expected to know all about lighting, and therefore each is dependent on the co-operation of the other to arrive at a solution. It is, however, a curious fact that the majority of very special lighting problems, the solving of which is of inestimable value to the industrialist, are capable of solution in a very simple and inexpensive manner, once they are tackled by a lighting specialist who really understands what his client requires.

Fig. 1. The Inspection of Fine Metal Parts, a process for which lighting with high pressure mercury electric discharge lamps is specially suitable.

Fig. 2. Motor Car Body Finishing—a case in which lighting of a particular quality and coming from a specified direction is found advantageous.

Three Main Types of Special Lighting.

Now, special lighting problems may be divided broadly into three main types.

A. Where the nature of the work calls for light of special quality or coming from a special direction, as for example, in many inspection processes and certain manufacturing operations, such as sewing.

B. Where the conditions of the surrounding atmosphere call for the use of special fittings or the special arrangements of standard fittings, as in atmospheres laden with acids or moisture or inflammable vapour.

C. Where special colour composition of light is required.

What is generally referred to as "local lighting" might be considered to be a fourth category of special lighting, but where such lighting involves nothing abnormal in the way of direction or quality and is merely necessary either to increase the general lighting intensity on certain parts of the factory or because the bulk of heavy machinery, etc., prevents the general lighting penetrating to certain places, the rules governing its application are broadly the same as those applying to general lighting and are not, therefore, pertinent to this article.

*We are indebted to the courtesy of Benjamin Electric Ltd. for the pictures reproduced in Figs. 2 and 3, and to the General Electric Co., Ltd., for the remaining illustrations.

Special "Quality of Light."

Let us then examine these three main types of special lighting problems. In the first place, what do we mean by special quality of light? It may be diffused from a wide angle as indirect lighting, or from a relatively small source, such as a glass steel diffuser; it may be concentrated from a wide angle as in the case of a shadowless operating theatre fitting, or from a narrow angle as with a narrow beam floodlight reflector, or it may have any of these properties mixed together in greater or less proportion, and light of any of these qualities may be arranged to reach the work from any direction and general angle of elevation.

Finally, in conjunction with any of the above characteristics the light may vary in spectral composition. Such variation in so far as it is the resultant colour of the light only that is considered, will be discussed when considering problems under category C, but other functions of spectral composition are pertinent to problems of the category that we are now examining.

Effect of Spectral Composition on Vision.

For example, under electric discharge lighting of the high-pressure mercury type visual acuity is increased and far sharper definition of objects of certain types is obtained. Whether this is due to a reduction of chromatic aberration, or to some power of the human eye to focus more accurately and rapidly under light from a source having a line spectrum of limited range than under that from a band spectrum covering the complete range of visible radiations, has not yet been fully explained. It is however, a phenomenon that has been proved of very practical importance in many inspection processes, notably those involving the detection of flaws in metal, such as pits, scratches, etc.

It is impossible in an article of limited length to examine in detail examples of the application of all the methods of lighting indicated above. Typical cases where angle and quality of light is of importance are provided in the local lighting of sewing machines, when the light has to be directed on to a certain side of the needle; in the built-in lighting of weaving machines, where light of a diffused quality is placed directly behind the threads to aid in the detection of broken threads; in the lighting of couch presses in paper mills where a concentrated beam of light is directed across the paper machine, to enable operatives to observe that the suction plant is working correctly, and examples could be multiplied almost indefinitely, and from almost every industry.

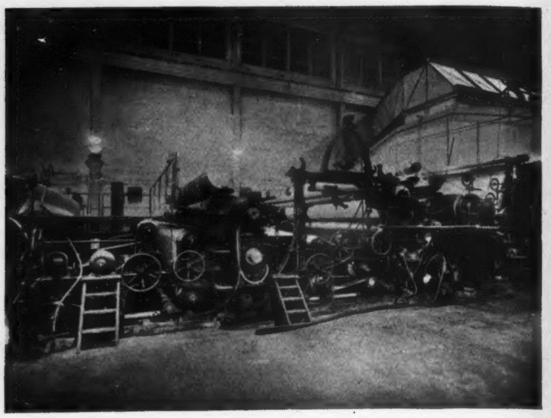
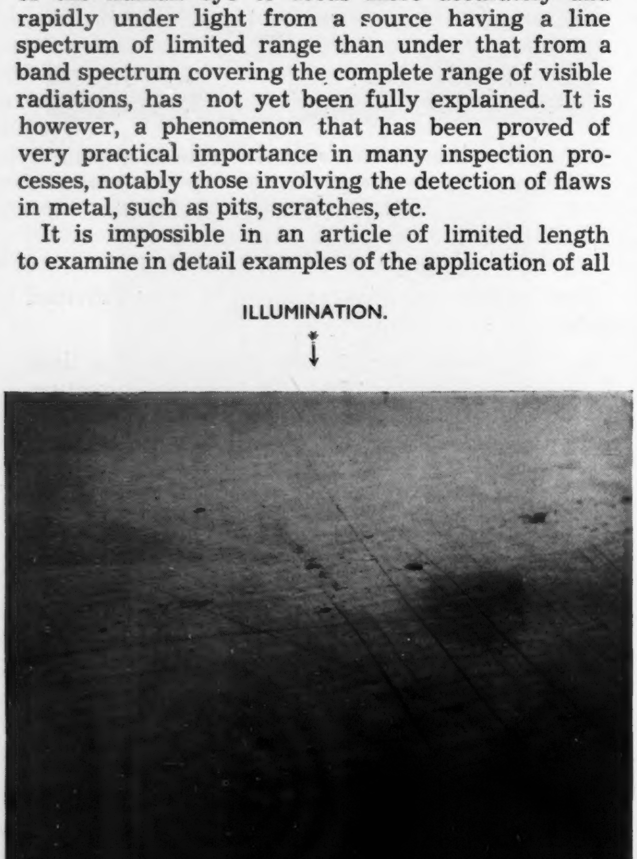


Fig. 3. A View of a Paper Mill—Directional Lighting is necessary across the Couch Press.

ILLUMINATION.



DIRECTION OF VIEW.

Fig. 4. Inspection of Tin Plates. In the illustration the presence of pin-points, revealed by the oblique illumination, is evident.

Lighting for Tinplate Inspection.

An examination of one investigation may, however, serve to illustrate the kind of issue involved, and for this purpose we will take an investigation recently carried out at the Research Laboratories of the General Electric Company, at Wembley, into the problem of lighting for tinplate inspection.

This investigation illustrates admirably the diverse nature of the problems involved, the necessity for close co-operation between the lighting expert, and the factory executive, and the simplicity of the solution when discovered.

It was first necessary for the lighting consultants to find out from the factory what faults the lighting must be designed to disclose. This subject was discussed at a preliminary interview, and it was found that the faults were mainly of three kinds, firstly, spots showing where the tinning had failed to take properly on the sheet iron, due to some dirt or impurity on the iron surface, secondly scratches on the face of the sheet, thirdly dents and corrugations. Of these three types of blemishes probably the first is of greatest importance in that a spot appearing little larger than a pin-hole immediately after tinning will not only rapidly cause a large blemish to appear on the surface of the tin, but will be a permanent weak spot liable to attack by corrosion. It will be realised that the lighting expert could not be expected to be aware of this until he was told of it, and this point illustrates the importance of full disclosure of requirements on the part of the factory.

An examination of the lighting problem soon indicated that there was no one type of lighting which would show up all three of these types of fault to equal advantage, and ultimately three separate systems of lighting were evolved, each depending on a different quality and angle of light and each designed to show one particular class of fault to advantage.

ILLUMINATION.

DIRECTION OF VIEW.

Fig. 5. Inspection of Tin Plates. Here the special method of lighting enables surface distortion to be readily detected.

Fig. 6. Inspection of Tin Plates. In this case the plate is illuminated diagonally and the direction of view is the same as that from which the light comes. Scratches are thus clearly revealed.

ILLUMINATION and DIRECTION OF VIEW

Detection of Spots, Dents and Scratches.

For the detection of the spots, it was found desirable to use a relatively large area diffuse light source such as is provided by an evenly illuminated opal glass panel.

For the detection of dents and corrugations, a similar light source was used, but covered with a grid of black bands.

Finally, for the inspection of scratches, quite a different system of lighting had to be employed, namely a concentrated narrow beam of light.

The final solution for all problems may appear complicated, but the whole of the equipment necessary is of the simplest construction, and could be installed for less than a ten-pound note. Yet the benefits in speed and accuracy of inspection and saving of faulty product are inestimable.

Application to other Problems.

The information gained in such an investigation may obviously be applied in other similar circumstances, but it is unwise to assume that two problems apparently similar necessarily are so. For instance, who would have guessed in the example quoted above that quite different types of lighting would be necessary for the detection of spots and scratches respectively on the same sheet of tin? The only sure solution for the industrialist dealing with such problems, is to call in the lighting expert to examine them on their merits, but first of all make quite sure that the lighting expert understands exactly what is wanted, a matter which can best be explained by practical demonstration. It is not fair to dismiss the lighting man as a fool simply because he does not know someone else's business as well as his own.

The other two special conditions, i.e., the use of special fittings in atmospheres laden with acids and inflammable vapour, and the treatment of processes where special colour composition of light is required will be dealt with in a subsequent article.

(To be continued.)

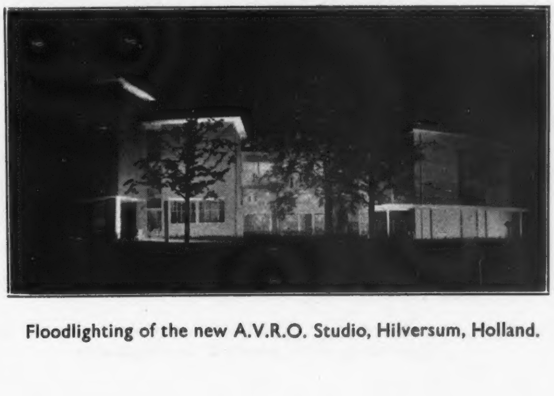
Ten Years of Architectural Lighting.

When did the conception of architectural lighting (Lichtarchitektur) first arise?

In a recent contribution* Dr. N. A. Halbertsma suggests that the origin is to be found in the address delivered before the Illuminating Engineering Society in Austria by Professor J. Teichmüller in October, 1926. Architectural lighting is thus just ten years old!

Novel forms of lighting fittings, which illustrated the underlying idea, were on view at the Exhibition of Decorative Art, held in Paris in 1925, and the "Gesolei" Exhibition in Dusseldorf in the following year afforded Teichmüller a fine opportunity of giving practical expression to his ideas.

Architectural lighting has since established itself firmly throughout the world. Dr. Halberstma enumerates a series of ten main results. Amongst the most important of these are closer relations between architects and lighting experts; elimination of glare; a revolution in fittings manufacture; the recognition that "efficiency" is only one of many factors to be considered, and—last, but not least—a means of getting money devoted to lighting at the commencement of building operations instead of at the end.



Floodlighting of the new A.V.R.O. Studio, Hilversum, Holland.

*"Die Lichttechnik"; Elek. u. Masch. No. 27, 1936.

Fig. 1. A view of one of the central thoroughfares (Sarsfield Street) of Limerick in the Irish Free State. This illustrates the appearance of the fittings by daylight.

Fig. 2. A night view of a similar installation in O'Connell Street, showing the good visibility obtained.

Street Lighting in Limerick (Irish Free State)

We are indebted to Mr. F. X. Algar, who is associated with the Electricity Supply Board, Dublin, for the accompanying pictures showing recent developments in the lighting of the city of Limerick.

In Figs. 1 and 2, day and night views of central thoroughfares lighted by similar methods are presented. The installations utilise 1,000-watt lamps in decorative lanterns suspended on span wires centrally over the carriageway at a height varying from 21 ft. 6 in. to 24 ft. 6 in., and at a distance apart of 40 yards. Fig. 2 suggests that the visibility by night is good, both roadway and pavement being well illuminated and the kerbline clearly evident.

The Taite Memorial Clock Tower (Fig. 3) is lighted by six 500-watt projectors. In this case, too, even illumination has been obtained and the memorial stands out very prominently.

The final two illustrations (Figs. 4 and 5) show the lighting of Sarsfield Bridge, which is effected by sixteen standards, each carrying a pair of 300-watt lamps in refractor fittings, mounted along the parapet. The height to the light sources is 15 ft. 6 in., the width of the thoroughfare between the parapets 40 ft., and the length of the bridge 560 ft.

We understand that all street lighting in Limerick (except floodlighting) is maintained in operation from half an hour after sunset until half an hour before sunrise throughout the entire year—

Fig. 3. A night view of the Taite Memorial Clock Tower, Limerick, which is permanently floodlighted from half an hour after sunset until midnight throughout the year.

a procedure on which the authorities are to be congratulated.

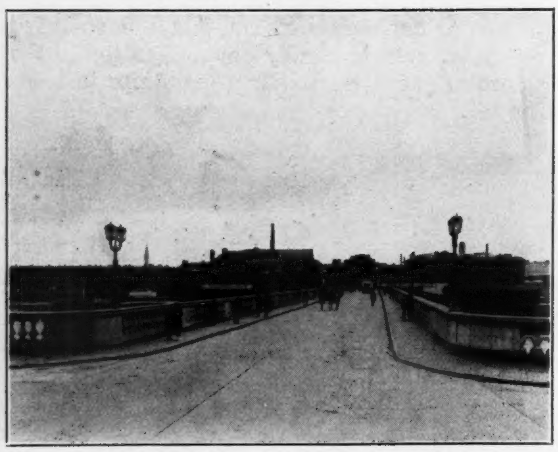


Fig. 4. Sarsfield Bridge, Limerick. A day view showing the appearance of the standards on the parapet.

Fig. 5. A night view of the same bridge showing its appearance by artificial light.

E.L.M.A. Lighting Service Bureau

34th Illumination Design Course in London

The 34th Illumination Design Course will open in London on October 12, when Mr. W. J. Jones will give an address on "Better Light—Better Sight." Other events will take place on successive Monday evenings (October 19 to November 16), and will include talks on Modern Electric Lamps (A. B. Whitworth), the Retail Shop Lighting Market (E. B. Sawyer), Industrial Lighting (J. W. Howell), Floodlighting (H. Lingard), and Lighting for Festive Occasions (R. O. Ackerley). At each meeting a member of the E.L.M.A. Council will preside, and someone with special interest in the topic will open the discussion. Those desiring to attend are advised to make early application to the E.L.M.A. Lighting Service Bureau, 2, Savoy-hill, London, W.C.2.

Progress Course in Illumination in Glasgow

A Progress Course in Illumination will be held in the Royal Technical College, Glasgow, and will open on October 1 at 7.30 p.m. when Mr. T. Catten will deal with Illumination Design. On subsequent Thursday evenings (October 8 to November 5) there will be talks on the New Science of Seeing (W. J. Jones), Industrial Lighting (J. W. Howell), Electric Discharge Lamps (L. J. Davies), Architectural Lighting (H. Lingard), and the Retail Shop Lighting Market (J. M. Anderson). In this case also the discussion will be started on each occasion by a local speaker. Those desiring to attend the course should communicate at once with the Lighting Service Bureau of Scotland, 29, St. Vincent-place, Glasgow.

Progress in Public Lighting

Developments at the A.P.L.E. Conference held in Cheltenham during Sept. 7th–10th

A Successful Conference—The President's Address—Street Lighting and Accidents—The M.O.T. Report—Methods in Holland—Effects of Colour—The Exhibition—Flood Lighting Displays.

In deciding upon Cheltenham for their Conference this year the Association of Public Lighting Engineers doubtless acted wisely. The Cheltenham Corporation are well used to Conferences, and their hospitality was on a generous scale. In addition, Cheltenham is a delightful centre—there can be few places in the British Isles whence so many beauty spots can be so readily reached.

There was an excellent attendance, and one was glad to see the Illuminating Engineering Society represented in the persons of its President, Hon. Secretary, and Hon. Treasurer. For the rest, the organisation of the Conference reflected great credit on the new secretary (Mr. H. O. Davies) and on Mr. W. J. Bache, the Borough Electrical Engineer of Cheltenham, in whose hands much of the work on the spot necessarily rested.

The proceedings were initiated by a reception and dance at the Town Hall on the opening evening, and the Conference was formally opened on the following morning, when an address was given by Sir Charles Bressey, of the Ministry of Transport. Following the morning session, luncheon took place at the invitation of the Cheltenham Gas Company. (Where else, one wonders, would a luncheon for over 600 people have been arranged in the Town Hall and carried through so expertly?) A very useful feature was the informal conversazione on Tuesday evening which afforded members and delegates opportunities of discussing knotty points arising at meetings and otherwise exchanging views. The annual banquet took place on the Wednesday evening.

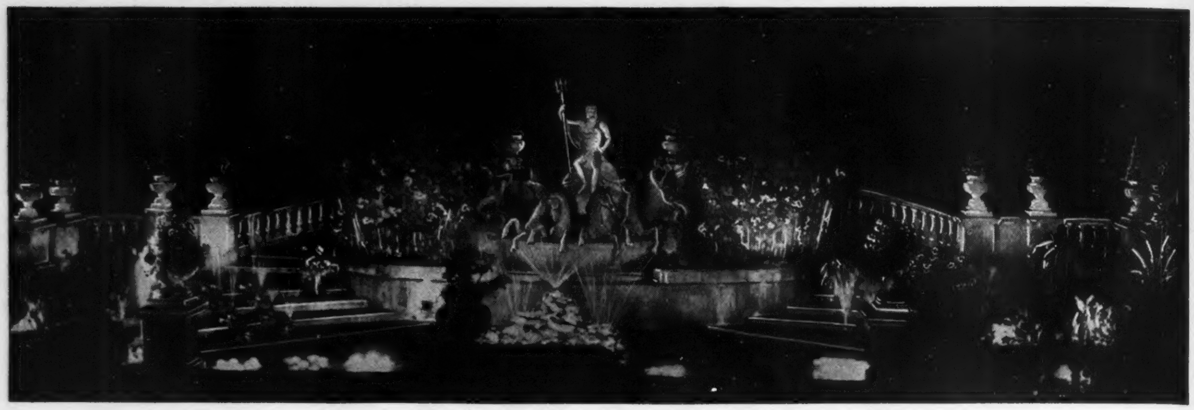
The papers were of a varied and interesting character. The only criticism that might be offered is that not one of them was prepared by a public lighting engineer capable of expressing both an expert and a wholly impartial view. Alderman Wilford, of Leicester, discussed the M.O.T. Report from a layman's standpoint. Professor G. B. v. d. Werfhorst gave a stimulating paper on lighting practice in Holland. Progress in electric street lighting was summarised by Mr. W. J. Jones, and gas lighting was treated by Mr. W. J. G. Davey and Mr. A. R. McGibbon. Kerbside lighting, a somewhat specialised but interesting problem, was handled by Mr. F. C. Smith, Mr. K. F. Sawyer, and Mr. D. G. Winslow. The final paper, by Mr. J. N. Aldington, which reviewed developments in electric lamps, was by no means the least interesting of the series.

Perhaps the contribution that excited most comment was that by Professor G. B. v. d. Werfhorst, whose speculations on the influence of the colour of light from sodium lamps were taken up keenly in the discussion and debated throughout the remainder of the Conference. (The Professor was frequently to be found, genially but firmly repelling the attacks of a group of visitors who were endeavouring, quite unsuccessfully, to convince him of error!)

The street lighting and flood-lighting demonstrations were on a considerable scale (seventeen of public lighting and fifteen main flood-lighting installations—seven gas and eight electric) were recorded in the official guide. A few of these are illustrated. A feature was the variety of extent to which hotels were floodlighted. One or two of those carried out by

The Queen's Hotel floodlighted in colour by the General Electric Co., Ltd. 5 kw. Red Osira lamps were placed in the forecourt on either side of the main entrance and to illuminate the two wings. The Colonnade above the main entrance was illuminated by five blue floods and thus appeared in striking contrast.

Cheltenham College. The floodlighting of the main front of the chapel is effected by a combination of G.E.C. floodlights, the total consumption being 50 kw. Medium range floodlights lighted up the main front and the set back of the first floor on either side was revealed by using sodium lamps. High pressure mercury floods were also used to show up the foliage of trees in front of the building.

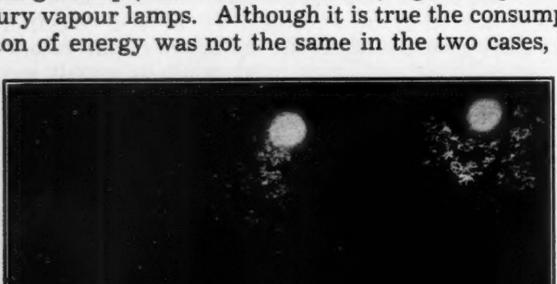


Floodlighting of the Promenade Fountain.—The lighting of the Promenade Fountain, carried out by the Strand Electric and Engineering Co. Ltd. Wide angle (500 watt) flooding lanterns were mainly used but 150 watt "Baby Sunray" Floods were applied to illuminate the foliage. Special "Fairyland" striplite with serrated reflectors was placed actually in the water. Three colours (red, green and blue), controlled by an automatic continuous blending motor-driven dimmer and giving an ever changing number of hues on to the running water and foliage were available. The picture gives some impression of the pleasing and fairylike effect of the lighting, though colour-reproduction would really be necessary to do justice to it. We understand that the photograph has been retouched to some extent—not of course in order to improve upon the impression received by the eye, which was quite good, but owing to certain difficulties experienced by the photographer in setting a correct rendering of this somewhat complex installation of coloured light.

simple methods with gas lighting were quite pleasing and effective, whilst more ambitious efforts with electric light, such as the lighting of the Queen's Hotel, utilised combinations of colours.

One of the most interesting situations was the junction of Queen's-road, lighted by sodium electric discharge lamps, and Lansdown-road, lighted by mercury vapour lamps. Although it is true the consumption of energy was not the same in the two cases, it was possible for anyone standing at the junction of the roads to get quite a good idea of the qualitative effect. During the period of the Conference there were frequent discussions by groups of visitors trying in this way to appraise their relative degree of visibility.

It was also a decided advantage to have available, in close proximity to the indoor exhibition, the open space of the winter gardens, in which units mounted on high posts could be conveniently displayed.



Landsdowne Place, Cheltenham, illuminated by Mazda Mercra lamps in the new B.T.H. Dilen lanterns. The length of the road is approximately a quarter of a mile and the width 45 ft. Two lanterns each using one 250 w. lamp were mounted on each cross span. The mounting height was 25 ft., the average spacing 165 ft., and the lateral distance between units (in part determined by the overhanging trees fringing the roadway) about 15 to 20 ft.

Cheltenham Parish Church floodlighted, a pleasing and serene effect. Mazdalux "Two and Three" floodlight projectors were used. The appearance of this and other church spires during the Conference was much admired and formed a feature of the floodlighting display.

Presidential Address

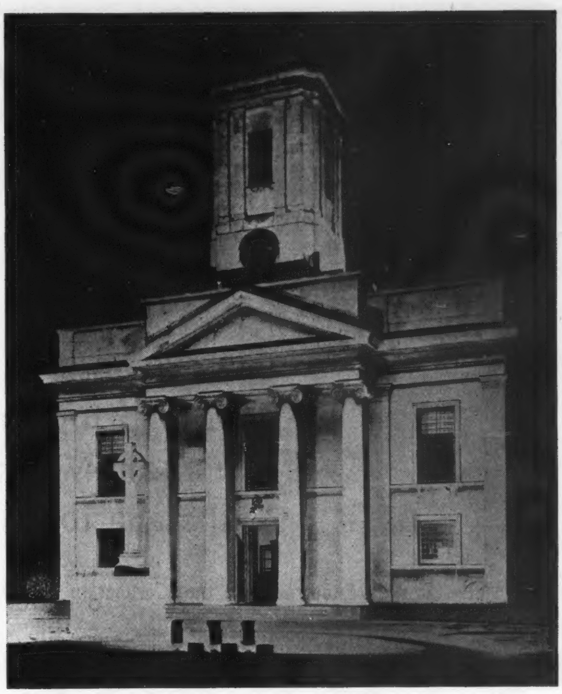
The address by the President (Mr. Edward C. Lennox) referred briefly to the Association's progress during the past year and to the issue of the M.O.T. Report.

Road Accidents.—Some interesting data on road accidents were next presented. Recent reports show that the greatest number of accidents occur between 5 and 8 p.m. in winter months, but between 10 and 11 p.m. during summer months, i.e., during the hours when artificial light becomes essential. Data for a main highway show that the proportion of traffic by night is still small, 5.7 per cent. in 1930 and 7.9 per cent. in 1935. It is shown, however, that the increase in night traffic during this period was 81 per cent. as compared with only 33 per cent. for day traffic. In view of these figures it is certainly striking that 52 per cent. of accidents during the winter months occur at night, when traffic is so much less than in the day time. The author estimated that the ratio of the accident risk at night to that by day is greater than 6.1. In America a ratio of 4.1 has been calculated, but on certain main traffic routes the corresponding ration for fatal accidents as high as 10.1. Comparative data for a 2-mile length of roadway before and after the installation of better lighting showed a reduction of 39 per cent. in the night accidents, despite an 81 per cent. increase in traffic.

The annual cost of public lighting in Great Britain is approximately £5,000,000. On the other hand the cost of road accidents to insurance companies is estimated at £25,000,000 per annum. If this item could be reduced by 10 per cent. the saving would enable the cost of public lighting to be increased by 100 per cent.

Administration.—Turning next to administration, the president mentioned that in the area of about 5,600 square miles dealt with by his company there were 124 lighting authorities (76 parish councils, 9 rural district councils, 36 urban district councils or non-county boroughs, and 3 county boroughs or cities). The conditions under which lighting is administered vary greatly. Conditions in two typical counties in the north-east area were compared. In one case there are 212 parishes in rural districts, 107 with street lighting and 105 with no lighting; in the other case, 456 rural parishes, 425 with street lighting and only 31 unlighted. Great benefits can be obtained if the resources of such rural areas can be pooled. In a typical case this arrangement resulted in a number of parishes getting lighting which before had none, in a 40% increase in the number of lamps and a total benefit (in K.W. hours) of 100%. This has been effected for a rate which is not more than the average rate paid by the various parishes concerned before pooling.

It appears, however, that it is usually difficult to bring about schemes of this kind. Until legislation is introduced which will make larger authorities the lighting authority conditions in rural areas will improve only slowly, and certainly not with uniformity. The suggestion that the cost of lighting main traffic routes should be assisted from the Road Fund appears fair and reasonable. The decision to introduce legislation for the taking over by the Ministry of Transport of responsibility for the maintenance of some 4,500 miles of the more important through traffic routes is welcome. The word "maintenance" should surely include the lighting of these roadways during the 46% of the year when darkness prevails.



St. Paul's Church, floodlit by six 400 watt Sieray electric discharge lamps in wide-angle floods, mounted about 30 feet away from the building, and two similar units with 250 watt lamps, one on each side of the clock-tower.

Motor Headlights.—In referring to the new Ministry of Transport regulations for the lighting of road vehicles, the president drew attention to the clause requiring the use of an anti-dazzle device and/or a dipping headlight. The use of headlights is essential on roadways where there is no adequate lighting. But on a well-lighted roadway a driver can see better without them and their use is unnecessary.

New Developments.—The introduction of new illuminants has drawn attention to an important question the effect of quality of light. For equal intensity of illumination visual acuity is said to be the same with all sources. Yet personal observation suggests that, at the low intensities usual in street lighting, contrasts are sharper and objects more quickly detected with a monochromatic or nearly monochromatic source than with light of a continuous spectrum. This field offers room for research.

The constant improvements in street lighting apparatus raises a query as to the justification for street lighting authorities entering into long-term agreements with private companies or utility undertakings. It is also suggested that, as authorities can borrow money at rates below those charged by private companies, they would do well to own the lighting installations in their respective areas.

Qualified Public Lighting Engineers.—Finally it is urged that the best benefit from equipment available can only be obtained when authorities appoint capable public lighting engineers. At present street lighting is usually referred to surveyors, who have many other duties to perform, and naturally cannot be expected to be experts in all branches of engineering. Engineers of public utility undertakings, gas and electric, are therefore asked to provide technical data for consideration—with the result that there is often misunderstanding. Larger towns have already realised the benefit of appointing expert lighting engineers to control their public lighting. If their example were followed extensively it would be to the advantage of public lighting and the public purse.

The M.O.T. Report from a Layman's Standpoint

A paper by Alderman W. E. Wilford, J.P., emphasised the importance of the M.O.T. Interim Report from the standpoint of the general public. From a traffic standpoint the whole country should be regarded as one unit. Modern fast traffic has wiped out all local and county boundaries. The development of housing estates constantly extends the area of local traffic. People are becoming more "night-minded," and many who formerly stayed at home visit cinemas, dance halls, racing tracks, etc.

Hitherto in England lighting has been "permissive," and the standard has depended on the outlook and enterprise of the local representative and the financial position of his local authority. Even if the authority is alive to the need of efficient and uniform lighting the cost to the rates of the smaller areas—estimated in some cases at 10s. in the £—would be prohibitive. But if the suggestions of the Committee are carried out it will mean that, for the first time, public lighting is regarded as a necessary public service.

Bad lighting is undoubtedly one of the causes of the terrible toll of accidents and fatalities on our roads. As a motorist, Alderman Wilford continued, he knew only too well the dangers of bad and variable lighting and the embarrassment of passing from the well-lighted centre of the city into the dimly-lit suburbs on a wet and dark night.

The Ministry of Transport had just undertaken the national responsibility for the making and maintaining of trunk roads. Surely the lighting of them was equally important, as 46 per cent of the time during which the roads were used was "dark time."

Lighting should be made an integral part of any new road scheme. The capital cost involved worked out at about 2 per cent. The selection of road-surfacing materials should be studied—a light matt surface was most desirable from a lighting and reflection standpoint.

All local authorities with a population of 100,000 and upwards should have a separate lighting department, advised by a competent lighting engineer—the expediency of this step had been proved in Leicester by experience over a period of twelve years. On the technical point of whether lighting should be done by gas or electricity, he was not qualified to give an expert opinion. He wished to stress, however, the paramount need for all road lighting organisations to be independent and free of either undertaking.

In conclusion he summarised as follows the conclusions which he drew from the report:—

Continuous, uniform, and efficient lighting on main traffic routes.

Reform of present methods of administration by taking it out of the hands of small local authorities and vesting it in the powers of municipal and county council authorities.

Creation of separate lighting departments with a fully qualified lighting engineer in charge.

Co-ordination and co-operation over large areas.

Government grant in aid, with national supervision.

A lighting research board to secure the most efficient technical methods of lighting.

Street Lighting Practice in the Netherlands

A very interesting paper on the above subject was read by Prof. G. B. v. d. Werfhorst, who recalled some characteristics of the Netherlands not unlike those prevailing in this country. The fact that the Netherlands is divided into 11 provinces and 1,070 boroughs each of which is completely autonomous and manages its own street lighting. In Holland there are national, provincial and municipal roads. But an important national road becomes a municipal road when it reaches a village—where the central government has no influence and where each borough decides its own mode of illumination.

Arterial Roads.

Several new arterial roads have recently been made by the central government and the cost of these is borne by a national road fund, to which motorists pay a special tax. In 1932 the provincial Electric Supply Company of Limburg installed sodium lighting over a section of a national road in their district and this example has been followed by several progressive boroughs. Contributors to the road fund then began to put pressure on the central government, urging them to improve the lighting of the splendid new network of arterial roads. As the central government has no such item as "lighting" in its budget, a new principle was involved. Ultimately a trial on the important Amsterdam-Holland road was agreed upon. In the meantime a number of boroughs are adopting the attitude of "wait and see"—in particular in regard to the length to which the central government will go in contributing towards bearing expense jointly with local boroughs.

City Roads and Rural Thoroughfares.

In the next section of the paper the author explained the difference in practice in streets in cities and on traffic thoroughfares outside. In the former case appearance of surroundings is important. For the sake of appearance it is usual therefore not to adopt completely screened fittings but "globe band fittings" which utilise a band of opalescent glass. The brightness of this band is not sufficient to cause glare and it allows a moderate amount of light to fall on the surface of houses, etc.

On traffic thoroughfares, however, where there are almost invariably no surroundings to be considered, attention can be concentrated on the illumination of the roadway and for this purpose completely screened fittings may be used. In this case the aesthetic effects of the colour of the light are of no consequence. Moreover colour-contrast is of little value in revealing objects at the low order of brightness met with in street lighting. The essential aim is to obtain good visibility, which is mainly governed by degree of contrast and the contrast-sensitivity of the eye.

Importance of Contrast.

Experiments have shown that, both by day and by artificial light, objects on the roadway are revealed by reason of their being darker than the road surface. Such objects (excluding occasional ones with bright surfaces such as light mackintoshes or aluminium-painted motor-cars) have usually co-efficients of reflection between 2 and 5 per cent., whilst the reflecting power of road surfaces and the environment

Sodium Lighting on the Haarlem-Amsterdam Road. Note that the cycle and tramway tracks are well illuminated, as well as the roadway. (We are indebted for this illustration to Mr. R. van Dijk, who contributed a description of the development of street lighting in Holland up to our last issue, Sept. 1936, pp. 277-280.)

usually lies betwen 15 and 35 per cent. For equal illumination, therefore, a brightness contrast greater than about 1:6 is not usually found. Our aim must be to increase this degree of contrast by making the brightness of the background (primarily the road surface) as high as possible and that of the object as low as possible. Hence in Holland the idea of aiming at high horizontal illumination has been superseded by the intention of securing high brightness of the road surface. Unfortunately high road brightness involves a high intensity from the lighting unit at angles slightly below the horizontal—a condition that is unfortunate in two respects, i.e., in increasing glare and thus lessening the sensitivity of the eye, and in increasing the vertical illumination and thus accentuating the brightness of vertical objects on the road. A compromise is therefore necessary, and practice has developed accordingly in the direction of greater mounting heights, smaller spacing and screened fittings with a cut-off angle of 75 per cent. to the vertical.

Advantages of Sodium Lamps.

The next point discussed in the paper was the choice of the lamps, in which connection the data shown in the adjacent table were presented.

Source of Light.	Brightness. *C.P. per sq. cm.*	Efficiency. *Lumens per Watt.*
Incandescent (Filament) Lamp ...	700	13—15
Mercury Vapour Lamp	150	40
Sodium Vapour...... Lamp	10	60

In regard to efficiency and brightness, therefore, the advantage lies with the sodium lamp. In regard to other qualities the following conclusions have been formed:—

Visual Acuity both in mercury light and in sodium light is better than in white light.

Speed of perception in sodium light is greater than in white light and also greater than in mercury light.

"Richness of contrast" is not manifested at brightnesses such as exist in a town centre.

Contrast-sensitivity is substantially the same for all three forms of light at brightnesses such as exist in a town centre.

Coefficients of reflection are also found to be about the same for the three forms of light.

In town centres the mercury lamp has come into vogue, partly because it reveals three colours,

whereas the sodium lamp is monochromatic. In towns where colour-values are admittedly important, combination of mercury and incandescent lamps, housed in the same fitting and with a combined efficiency of about 20 lumensper watt find application.

In the concluding portion of the paper some reference is made to the use of lighting units in which the new super high-pressure mercury lamps, yielding 3,000 lumens for a consumption of 75-80 watts, are combined with incandescent lamps of 150 or 200 watts for town use.

On traffic thoroughfares, however, in the open country, sodium lighting is being extensively developed.

Accentuation of Contrast at Low Illuminations.

Professor G. B. v. d. Werfhorst then entered upon a somewhat intricate analysis of the effect of sodium lamps based on the consideration of "apparent brightness" and "richness of contrast." The former term is used to indicate the actual impression received by the eye which at low illuminations is profoundly affected by the visibilty curve. The author presented the familiar diagram showing how this curve of sensitiveness throughout the spectrum has its maximum in the yellow at high illuminations, and how the maximum shifts into the green under conditions of "night vision." As a result of this change in sensitiveness the apparent relative brightness of two objects receiving light from certain sections of the spectrum only may be altered considerably as the illumination is weakened. The actual contrast may be either diminished or accentuated according to the region of the spectrum from which light is received. In the case of sodium an accentuation of contrast at certain illuminations is found. In the case of the mercury vapour lamp, however, it may happen that whilst the contrast is apparently increased for certain components of the spectrum, it is actually weakened in the case of others. Under suitable conditions, it is suggested the "apparent contrast," which depends on this physiological effect, may be four times as great as the physical contrast existing at higher illuminations!

The adjacent table, taken from the author's paper, shows the conditions that may arise:—

Brightness of Road. *C.p. per sq. cm.*	Mean Illumination.	Factor of Contrast Increase.	Contrast Ratio. *As seen.*
30×10^{-6}	0.4 – 0.5	4.0	1 : 40
60×10^{-6}	0.8 – 1.0	2.5	1 : 25
100×10^{-6}	1.4 – 1.6	1.9	1 : 19

Is Uniform Brightness Essential?

This accentuation of contrast, however, may operate in another way, and this time not to the advantage of sodium lighting. At low illuminations it causes variations in brightness on different parts of the road to be emphasised, and this apparent inequality sometimes leads to the mercury light being preferred to the sodium. It is contended, however, that it is only when the illumination is unduly low that this occurs on the road-surface. At relatively high illuminations there should be no material difference in this respect between the two forms of lamps—though the advantage of increased contrast between brightness of the road-surface and that of relatively dark objects upon it still persists.

The author, however, quotes a view to the effect that completely uniform brightness of the road, so far as the eye can see, would not be advantageous. The eye of the motorist needs guiding points in order to be able to judge distance and estimate speed and in order to avoid dangerous relaxation as the result of monotony.

Modern Gas Street Lighting Installations

In a paper on this subject by Mr. W. J. G. Davey and A. R. McGibbon, the B.S.I. specification and the M.O.T. report were reviewed from the standpoint of gas lighting. One probable result of the report will be an increase in mounting heights for units in certain districts. There is some ground for preferring 20 ft. to 25 ft. as a mounting height. In any case the effect of the extra 5 ft. is not great. It is pointed out that increased mounting height always results in lower average illumination, and unless it is considered in conjunction with spacing it may also result in decreased illumination at the mid-span point. As the height of the lamp is increased two opposing factors are in operation. Decreasing the vertical angle tends to increase the horizontal illumination at the point considered, whilst the increasing distance has the opposite effect. It is recalled that the limiting mounting height to give maximum illumination corresponds with the relation $H=D/\sqrt{2}$ where H is the mounting height, and D the distance of the point from the lamp base. This corresponds to a vertical angle of $\tan^{-1}\sqrt{2}=54° 42'$.

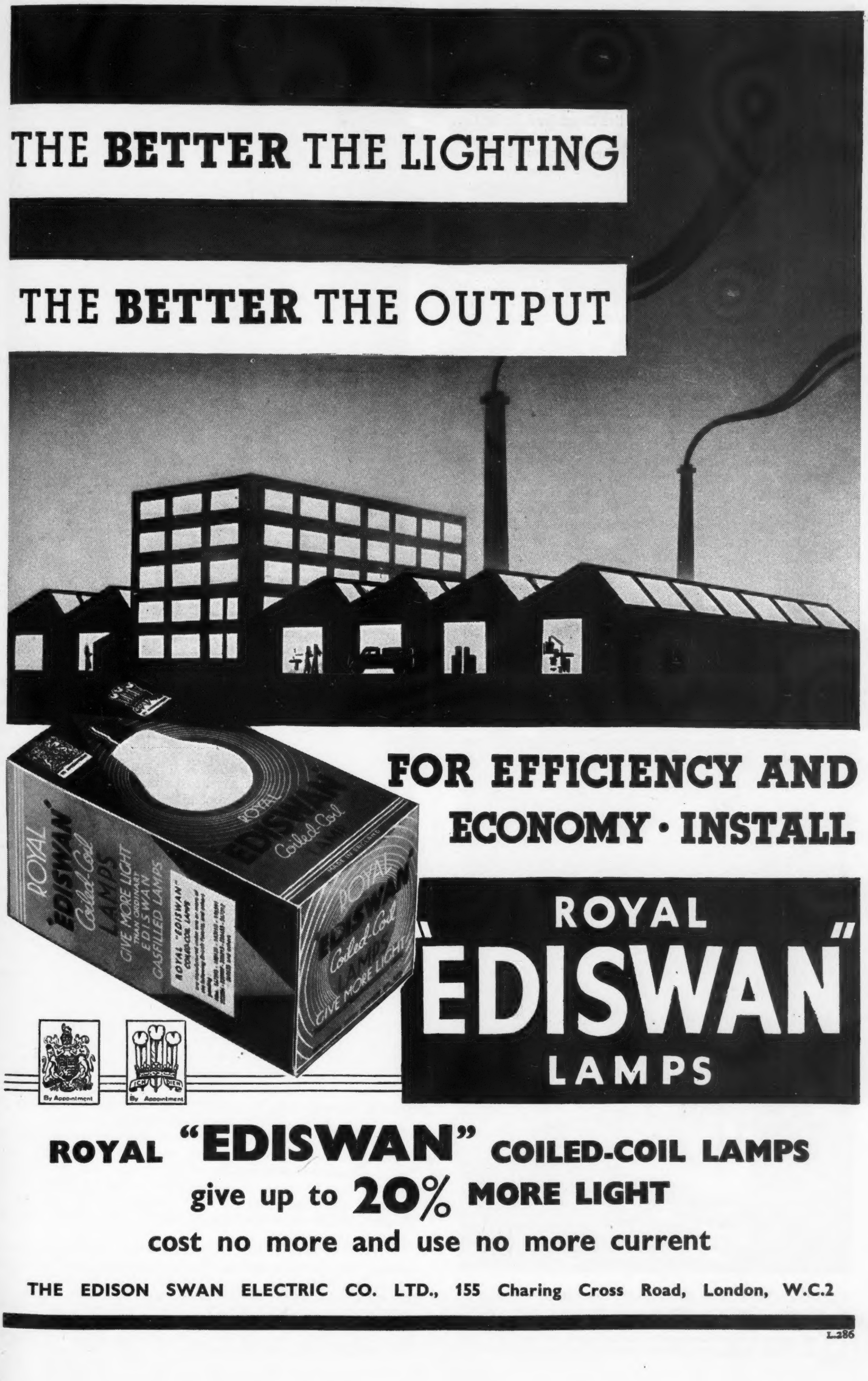
Emphasis is placed on the importance of reducing the "district diversity factor" (i.e., the contrast in brightness in adjacent streets in a district). If, for example, a Class H street opens into a Class A thoroughfare, anyone turning into the side street will find the darkness intensified, whilst conversely a person turning into the main road will be dazzled.

In a scheme initiated in Wandsworth lamps are placed at the junctions of main roads and side streets. The first lamp in the side street is then placed 70 ft. from this lamp, the second at a distance of 100 ft., and the third 150 ft. away, i.e., the normal spacing. An alternative arrangement adopted in Bournemouth consists in gradually increasing the candlepower of lamps in side streets as the main street is approached.

In a brief discussion of methods of presenting data on street lighting the authors express a preference for the iso-foot-candle diagram. A word of caution is given in regard to photographs of street lighting installations, whilst road brightness diagrams only apply in certain defined circumstances—results being at once altered by changes in weather and atmospheric conditions.

In the concluding and most lengthy portion of the paper data on several familiar forms of gas lamps recently introduced are given, and photographs and figures relating to a series of nineteen installations are presented. The tabular data are instructive. Installations in classes D to G are summarised, and one B installation (Stechford, min. illum. 1.04 ft.-c.) is recorded.

[In our next issue we propose to deal with the three remaining papers read at the Conference, "Progress in Electric Street Lighting," by W. J. Jones, "Kerbside Lighting," by F. C. Smith, K. F. Sawyer and D. G. Winslow, and "Developments in Electric Discharge Lamps," by J. N. Aldington.]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The Exhibition

The Exhibition, as mentioned above, was assembled partly indoors and partly in the Winter Gardens. The latter served mainly for gas lighting exhibits, a notable item being the display of Supervia h.p. lamps, mounted on seamless steel posts 25 ft. high furnished by the Bromford Tube Co., Ltd., around the bandstand.

In all, there were thirty-one exhibitors, of whom six were definitely associated with gas lighting and twelve with electric lighting, and the remainder either with both systems or with control or measuring apparatus, etc.

Gas Lighting.—The British Gas Federation devoted their stall to general information on gas lighting, photographs of installations, etc. Modern types of gas lamps were shown in variety at the stalls of Foster and Pullen, James Keith and Blackman, Ltd., C. H. Kempton and Co., Ltd., W. Parkinson and Co., and Wm. Sugg and Co. The first named, who also staged a display outside the main entrance to the hall, had a varied range of 6 and 12-light alignment burners, in which good use is made of mirrors and also units employing specially designed Holophane refractors. The chief item in the display of James Keith and Blackman, Ltd., was naturally the Supervia lamp, whilst W. Parkinson and Co. featured the "Maxil" lamp, stated to be specially designed to meet the M. O. T. requirements. At the stall of C. H. Kempton and Co., Ltd., one was interested to see, besides their familiar gas lamps, a novelty of considerable interest, namely, a demonstration of the uses of the portable "Calor Gas" outfit, which deserves to be more widely known. Calor gas was also seen in operation at the stall of Gowshall, Ltd., for the illumination of guard posts—evidently a promising development. Wm. Sugg and Co., Ltd., had a varied display, which included illuminated signs and floodlights, as well as lamps. They also included two special exhibits, a model of the mirror head photometric equipment, recently described in this journal, and an automatic switch, enabling gas lighting to be brought into operation in an emergency.

Electric Lighting.—At the stalls of the chief firms concerned with electric lighting there were many forms of lanterns familiar to our readers. It is only possible to mention a few. The G.E.C. stall featured the familiar

The General Post Office, Cheltenham, floodlighted by means of 11 Ediswan "Saturn" floodlanterns equipped with 400 w. Escura lamps and one "Sirius" lantern similarly equipped. The equipment was mounted on two planes, one set on the 1st floor balcony and the other at ground level.

Floodlighting of St. Gregory's Church, Cheltenham, by Gas (Sugg) 10-burner parabolic floodlighting units.

"Lewisham" and "Di-Fractor" types, a new lantern for 150-w. lamps, and a display of Osira colour floodlighting equipment. The B.T.-H., Ediswan, and Siemens displays were on similar lines. Amongst the units one noted the new B.T.-H. lanterns ("Dilen" and "Diref"), the Ediswan "Northbury" form, with its highly adjustable but simple reflector system; whilst at the Siemens stall one observed the Sieray-dual lamp (a speciality where reasonably good colour values are desired) and the new horizontal burning floodlighting colour units, of which there was an impressive display. An interesting new type of lantern for sodium lamps was exhibited by Engineering and Lighting Equipment Co., Ltd., which combines screening with a translucent area of moderate brightness. Revo Electric Co., Ltd., also showed an interesting form of fitting (the "Hoodalite") for sodium lamps, furnishing screening with an adjustable cut-off. The Philips stall was divided into two sections dealing respectively with sodium and mercury vapour Philora discharge lamps. Sodium lighting was, however, emphasised by the excellent model of a lighted street, in which the effect of distance was cunningly secured.

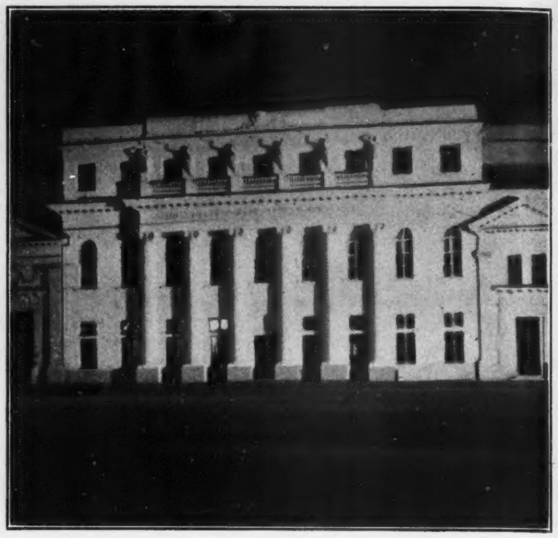
Other representative displays of electric street lighting equipment were those of Simplex Electric Co., Ltd., the Wardle Engineering Co., Ltd., and the Electric Street Lighting Apparatus Co. The Strand Electric and Engineering Co., Ltd., concentrated mainly on "festivity lighting," and showed a variety of floodlighting equipment suitable for use in the coming Coronation celebrations.

Holophane, Ltd., are in a class by themselves in that they furnish scientific equipment for both gas and electric lighting. The Duo-Dome range of refractors for gas lighting and various forms of ornamental refractor lanterns for pedestal lighting (such as the "Lennox") and Holophane-Edgcumbe photo-electric photometers for street lighting were all on view.

A final reference may be made to the display of a newcomer, the Curtis Lighting Co. of Great Britain, Ltd., some of whose fittings are illustrated elsewhere in this issue, to the excellent display of the Horstmann Gear Co., whose new synchronous motor attracted much interest; and to the show put up by Radio-Visor Parent, Ltd., whose light-actuated apparatus seems to be finding wider and more varied application than ever.

Lighting Development in the U.S.S.R.

We are indebted to Mr. Paul Grundfest, of Prague, who has recently been paying a visit to the U.S.S.R., for the accompanying notes and illustrations. Lighting development in that country seems likely to prove very rapid, and should be watched with interest.



Floodlighting of the so-called "Pionierhaus" in Charkov.

There is a lamp factory (Svetlana) in Leningrad which employs 22,000 workers, operating in three shifts, so that work proceeds continually throughout a 24-hour day. During the last four years about 130,000,000 incandescent lamps were produced in the U.S.S.R.

These and similar figures show that the demand for lighting has increased very substantially during recent years, just as in other countries where progress towards a higher cultural state has recently been rapid.

Until the year 1930, however, it was scarcely possible for the lighting expert to occupy himself much with his field of work because the U.S.S.R. was still struggling with its most important problems, namely, the development of its heavy industries. Up to that year some milliards of roubles had been expended abroad for the purpose of developing these fundamental industries, which it was desired ultimately to render independent of outsiders. It was only after this urgent need had been satisfied that attention could be devoted to the production of commodities, and in particular to the development of the lighting industry.

Thus it comes about that the development of modern lighting and its appliances has only been undertaken during the last five years. Yet, even during this period, substantial progress has been made. The experience which the rest of the world had gathered since 1920 was now available to the U.S.S.R., so that progress at once commenced on foundations established in other countries.

Developments in the field of illuminating engineering are pursued by the "W.E.I.", the central institute for electrotechnics in Moscow, in the Optical Institute of Leningrad, etc. Such institutes devote themselves to fundamental problems on their own initiative, and also deal with those arising in practice and presented to them for solution. There is also a further body which is concerned with international terminology.

The construction of the "W.E.I." Institute was commenced on instructions issued by Lenin in the year 1927 and was completed in 1930. It constitutes the centre of the entire electrical heavy current industry and includes a variety of sections, of which lighting and illuminating engineering form one. This section studies such matters as electric discharge lamps, photometry, and the use of photometric cells, the standardisation of lighting units, artificial daylight, etc. Numerous types of lighting fittings have been developed including asymetric types for street lighting; also a form of artificial daylight obtained by the combination of mercury vapour lamps with the usual incandescent (filament) lamp. Units of this type, with the lamp enclosed within an opal glass globe 50 centimetres in diameter, are applied to street lighting and have an excellent effect.

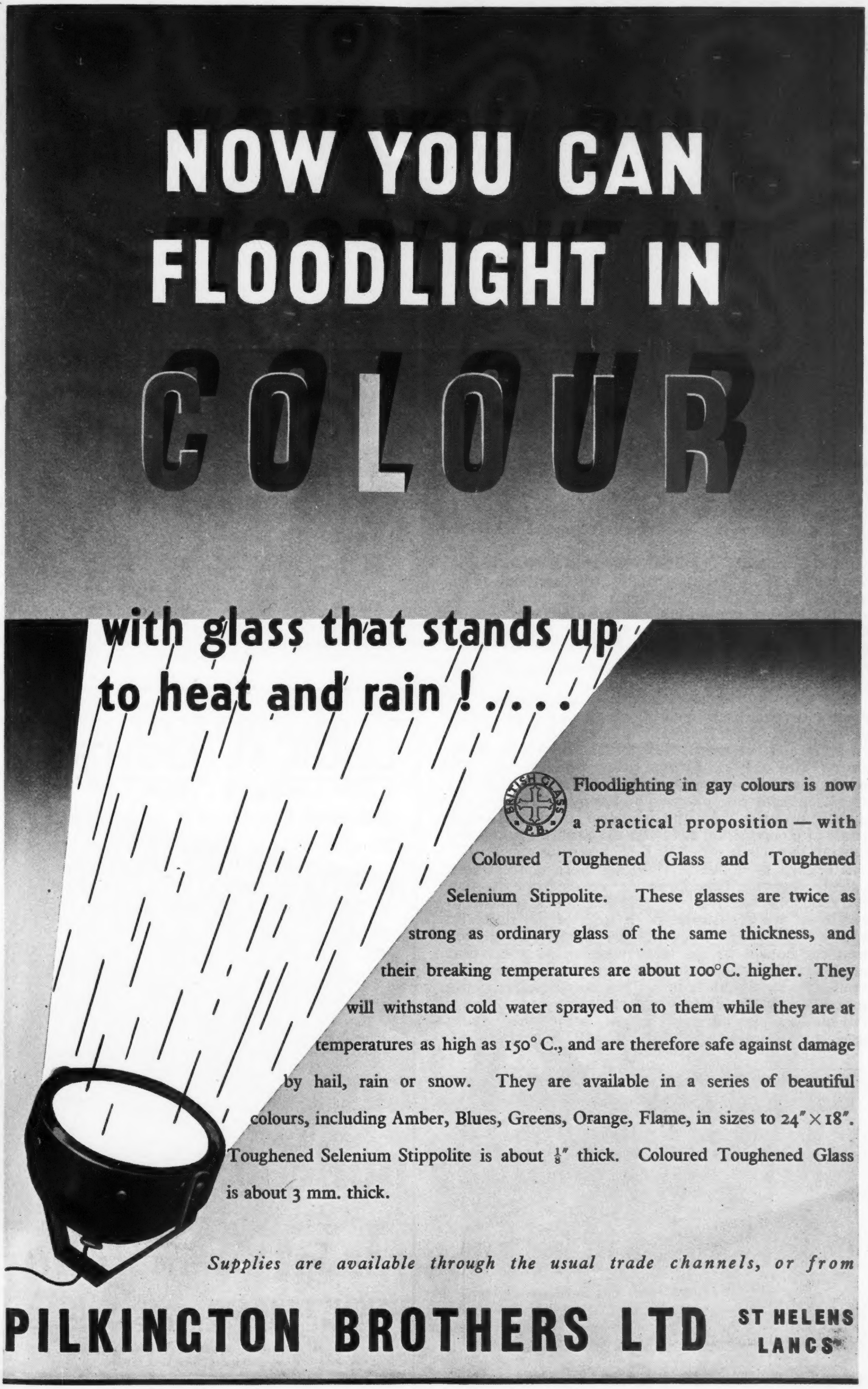
At the Optical Institute in Leningrad there are about 900 workers. Many problems which have recently figured prominently in literature on lighting, such as those concerned with daylight, faults in glass, photometric cells, etc., are being studied. The writer also observed in the institute a model of the proposed Soviet Palace, a building to be erected in Moscow and which is to rise to a height of 500 metres —thus forming the highest building in the world. The institute is studying the admission of daylight into the vast assembly room of this new building designed to hold 10,000 persons.

After this introduction the writer proposes to say a few words on the main objects of interest to be seen in some of the chief cities in the U.S.S.R.

Moscow, a town with 3,600,000 inhabitants, seems destined, in the course of the next ten years, to become the most completely modernised city in Europe. In this period quite half of the city is to be pulled down and completely rebuilt, and enough can already be seen to lead one to believe that this scheme will actually be carried through.

Complete New Building, Le Corbusier, Moscow.

Wherever new streets and squares are being laid out the street lighting is also being modernised. The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main streets and squares will throughout be illuminated by means of powerful projectors operating from roofs of houses, so that fittings will disappear from the street entirely.

One square in Moscow (Rote Platz) is mainly illuminated from two sides only, because the third and fourth sides (occupied by the Kremlin and Cathedral) are, from the architectural standpoint, unsuitable for the mounting of reflectors. Nevertheless, the illumination of this square appears uniform though, according to our ideas, the intensity of illumination is perhaps hardly sufficient.

At cross-roads, luminous traffic signals of the modern indicator type are used. There is a rotating pointer travelling over the red—yellow—green—yellow—luminous panes forming the background, thus showing how long any particular colour signal is to remain in operation.

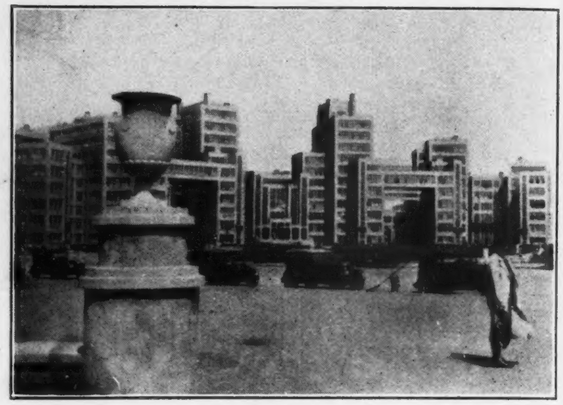
Luminous signs, in the sense which we know them, are naturally few at present. It is true that the large stores and the international hotels bear neon signs, but these are exceptions. On the other hand the head of the Leader (Stalin) is often outlined in neon on the roofs or on the face of the building. Cinema theatres also frequently make use of luminous advertisements of a highly decorative and effective character. Buildings of outstanding characteristics are occasionally floodlighted. One of the most pleasing examples is the great Theatre in Moscow and another the so-called "Pioneer House" in Charkov.

In the U.S.S.R., every citizen shows a great personal interest in the development of the national plan. Statistics bearing thereon figure very prominently not only in newspapers but also in advertisements on the frontages of houses. (In Moscow, for example, there exists on one frontage an animated luminous sign illustrating progress in developing a gold reserve!).

The recently opened Metropolitan Railway in Moscow reveals striking applications of modern lighting methods. Every station is executed in a different style and the method of lighting is varied accordingly. Not only do fittings differ from another but direct, semi-indirect and complete indirect lighting are all brought into play. The happy solution of the lighting problem from the aesthetic standpoint is the result of co-operation between the architects and the lighting experts of the "W.E.I." Institute.

In regard to domestic lighting there is relatively little to report. This, however, arises from the fact that housing has not yet reached the standard to which we are accustomed. In spite of the fantastic speeds with which buildings are being put up, the need for houses in the large cities is so great that hundreds of thousands cannot even yet find the minimum of accommodation. This condition is being remedied very quickly. Nevertheless, several years will elapse, especially in Moscow, before this urgent need is completely satisfied. It will be understood,

The Hotel Moscow, with over 1,000 rooms.



The Palace of Industry (Charkov).

therefore, that improvement in the comforts of the home can only be gradually introduced and that domestic lighting as yet is only in its beginnings.

In contrast the illumination in hotel rooms is good and in new buildings efforts are made to introduce the most modern methods. The great "Hotel Moscow" will, when completed, contain 1,000 rooms and will be among the most modern hotels in Europe.

In the U.S.S.R., building is thus proceeding very rapidly. Illumination is also developing at express speed and it is to be expected that the level of conditions in Europe will very soon be attained. As the State is in a position to invest money seriously in such projects, it may well be that efforts in the U.S.S.R. will lead to remarkable results and provide an instructive object lesson to other countries.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from September, Page 284)

III.—PHOTOMETRY.

208. Colorimetry.

Gustave Ribaud. Rev. d'Optique, V. 15, No. 5, p. 162, 1936.

A survey of the resolutions of the international Commission on Illumination, Cambridge, 1931, and Berlin, 1935, on Colorimetry. R. G. H.

209. The XYZ System of Colorimetric Representation.

J. Escher-Desrivières. Rev. d'Optique, V. 15, No. 5, p. 182, May, 1936.

Gives the principles of the colour-triangle method of colour representation, and shows how its use can aid the work of those engaged on signal glass colorimetry. R. G. H.

210. A Comparison of Phototubes and Photocells.

E. D. Wilson. Electric Journal, p. 307, July, 1936.

Discusses the sensitivity of different types of photoelectric devices to radiation of different wavelength, and shows how the sensitivity can be controlled or limited. R. G. H.

IV.—SOURCES OF LIGHT.

211. Luminous Tubes.

J. T. Corthine. Elect., 117, p. 166, August 7, 1936.

An account is given of recent developments in electrode construction for luminous tubes. C. A. M.

212. Fluorescent Tubes.

Anon. El. Times, 90, p. 208, August 13, 1936.

A photograph and short description of an application of fluorescent discharge tube lighting. Fluorescing mercury discharge tubes and neon discharge tubes are claimed to give any grade of light within the daylight range. W. R. S.

213. Sodium Discharge Lamps.

Anon. El. Rev., V. cxix., No. 3065, p. 245, August 21, 1936.

Gives working notes on the sodium discharge lamp as used for street-lighting purposes, and enumerates the advantages of this type of illuminant. R. G. H.

214 New Products.

Anon. Light, V., p. 45, June, 1936.

Two types of simple fittings for use with silvered bowl lamps are described. In one the luminous brim of the fixture is made of buckram, and may be replaced when soiled. C. A. M.

V.—APPLICATIONS OF LIGHT.

215. Better Light—Better Sight.

W. J. Jones. El. Rev., V. cxix, No. 3068, p. 335, Sept. 11, 1936.

A description of the lighting improvement campaign. Photographs are given as examples of the value of correct illumination. R. G. H.

216 Reducting Street Accidents.

E. C. Lennox. El. Rev., V. cxix., No. 3068, p. 344, Sept. 11, 1936.

A paper giving data on the costs of road lighting, and suggestions as to improvements in administrations. The problem of the best type of source to use is also discussed. The paper was the subject of the Presidential Address to the A.P.L.E. Conference. R. G. H.

217. Let's Light Nation's Schools.

F. A. Kolb. El. World, 106, p. 2326, August 1, 1936.

The author discusses the lighting of classrooms. He gives suggestions for improving existing standards, and reports the results of tests to determine suitable values of illumination. S. S. B.

218. New Treatment for Library Lighting.

Anon. El. World, 106, p. 2544, August 15, 1936.

Details and photographs are given of the lighting of a memorial library at the University of Utah. A series of artificial skylights is used in the main hall, and diffusing glass panels extending the whole length of the corridor are used in the hallways. S. S. B.

219. Lighting Store and Factory.

Roy A. Palmer. El. World, 106, p. 2350, August 1, 1936.

The author discusses the scientific aids now available to the lighting salesman. He quotes several installations where considerable improvement has been made by scientific planning, and includes photographs. S. S. B.

220. Mazda-Mercury Light for Mirror Grinding.

Anon. El. World, 106, p. 2531, August 15, 1936.

Special requirements present themselves in the lighting of the astrophysical optical shop, where control of

temperature is of great importance. The installation described uses a combination of 1,000-watt incandescent lamps, with special heat-absorbing filter, and Cooper Hewitt mercury lamps. S. S. B.

221. Best in Baseball Lighting at Low Cost.

E. K. Albert. El. World, 106, p. 2319, August 1, 1936.

Some details are given of the arrangement of floodlighting on American baseball field. Illumination values of 15-25 foot-candles are obtained, with a consumption of 180 kilowatts. S. S. B.

222. The Lighting of the R.M.S. Queen Mary.

T. E. Ritchie and E. H. Penwarden, G.E.C. Journal. VII., pp. 157-170, August, 1936.

The problems of design of lighting equipment for marine work are discussed, with particular reference to the dissipation of the heat energy which results. Typical equipment is described in detail, together with average values of illumination resulting. C. A. M.

223. Exhibition Lighting.

Anon. Elect., 117, p. 196, August 14, 1936.

A brief description is given, with photographs, of the spectacular lighting of Cleveland, Ohio, Great Lakes Exposition. C. A. M.

224. Lighting the Fair at Cleveland.

H. M. Hays, Electric Journal, p. 376, August, 1936.

Describes, with photographs, a number of novel installations at the Cleveland Exposition. The floodlighting is on a particularly lavish scale, tungsten filament lamps being employed in most cases. R. G. H.

225. Electric Signs in Tokyo.

Anon. El. Times, 90, p. 237, August 20, 1936.

Photographs of electric lighting effects in Tokyo. W. R. S.

VI.—MISCELLANEOUS.

226. Polarisation of Light and Some Technical Applications.

A. F. C. Pollard. Nature, V. 138, No. 3486, p. 311, August 22, 1936.

Traces the development of polarising materials to E. H. Land's invention, from which has been developed the "Polaroid" type of material. Suggested applications for the new material are discussed. R. G. H.

227. Irradiation of Plants.

V. Sinclair. El. Rev., V: cxix, No. 3067, p. 308, September 4, 1936.

Describes, with photographs, experiments on plant irradiation, in which optimum period of treatment, type or radiation to employ for different plants, and necessary illumination, are discussed. R. G. H.

Recent Patents

(*Abstracts of recent Patents on Illumination & Photometry.*)

No. 447,022. "Improvements in and Relating to Boundary Beacon Lights for Airports."

Curran, E., November 21, 1935.

This specification relates to aerodrome boundary beacons of the kind comprising a bollard adapted to be knocked over when struck, and provided with contacts in a base member which co-operate with contacts in the bottom of the bollard, when the latter is erect, to supply electric current for light source in the bollard. Switches are connected in the circuit of each contact of the base, and resilient means tend to maintain the switches open. Means are provided by which the bollard, when erect, closes the switches. Thus, when the bollard is knocked over, the contacts in the base are disconnected, thus avoiding risks of electric shock and short-circuit through the exposed base contacts.

No. 449,161. "Improvements in Lamp Carbons for Optical Projection Apparatus."

Champion, C. H., October 29, 1935.

In optical projection operation it is frequently advantageous to project a beam of non-circular section, for example, in the case of cinematograph projectors having a rectangular gate. According to this specification, an arc carbon has a single core of non-circular cross-sectional shape. The core may be rectangular or of such a shape as to tend to form a rectangular crater. The core may contain rare earth minerals, including cerium fluoride.

No. 449,290. "Improvements in or Relating to Projectors, Head-lamps, or the Like Especially for Use on Vehicles."

Izikowitz, J. S., October 18, 1935.

This specification covers a projector or head-lamp comprising at least two sources of light. One source of light is arranged to the rear of the other and the forward one with a reflector is arranged in a casing. The rear-light source is provided with an ellipsoidal reflector, the effective surface of which is positioned mainly above a horizontal plane passing through the lower front edge of the casing containing the forward lamp and its reflector when the projector is horizontal. The remote focus of the ellipsoidal reflector is located adjacent to the edge of the casing or between that edge and the rear-light source. The rear-light source itself is located at or close to the inner focus of the ellipsoidal reflector. With this disposition neither the ellipsoidal reflector nor the light source therefore is directly visible to an observer in front of the lamp and substantially above the horizontal plane through the lower edge of the casing. The ellipsoidal reflector, however, casts a fan-like beam below that horizontal plane.

No. 449,292. "Improvements in Lamp Reflectors and Lenses Therefor."

Dietrich, F. R., December 17, 1934. (*Convention, Germany*).

According to this specification, a lamp reflector is of ellipsoidal shape, the axis of the ellipsoid, having a ratio between 1:2 and 1:4.5, and a dispersing lens is provided in the aperture of the reflector at a distance from the pole not exceeding one-half the length of the major axis to render substantially parallel the rays which would otherwise converge in the remote focus of the ellipsoid. The lens may occupy only part of the aperture, and the other part may be occupied by a transparent prism.

No. 449,575. "Improvements in or Relating to Illuminating Projectors, More Especially to Those Intended for Motor Cars."

Société Pour La Fabrication Des Projecteurs Electriques Marchal. March 23, 1934, (*Convention, France*).

This specification describes a light concentrating device applicable to light projectors provided with a principal reflector for concentrating one portion of the light. The device comprises two auxiliary reflectors of small dimensions disposed in front of the electric lamp bulb, the inner surface of the outer auxiliary reflector reflecting light from the lamp on to the outer surface of the inner auxiliary reflector, whence the light is reflected outwards in a substantially parallel beam. The surfaces of the auxiliary reflectors may be portions of ellipsoids, paraboloids, toruses, or cones. The whole device preferably has a diameter not exceeding that of the lamp bulb.

No. 449,581. "Improvements in or Relating to Lighting Fittings."

Charles H. Bell and Company, Limited, and Collinson, G. W. April 8, 1935.

This specification describes a lighting fitting for indirect lighting comprising an elongated base having alternating ridges and valleys, each ridge having oppositely inclined reflecting surfaces and the bottom of each valley being constituted by an intermediate member having a reflecting surface. One of the inclined reflecting side portions of each ridge is provided with a lamp socket to receive an incandescent lamp bulb, and to hold it in an upwardly inclined direction above the adjacent intermediate reflecting member. The ridges are preferably of V-shape, and the inclination of one side to the vertical may be greater than that of the other side.

No. 499,810. "Improvements in and Relating to Lighting Devices and Systems."

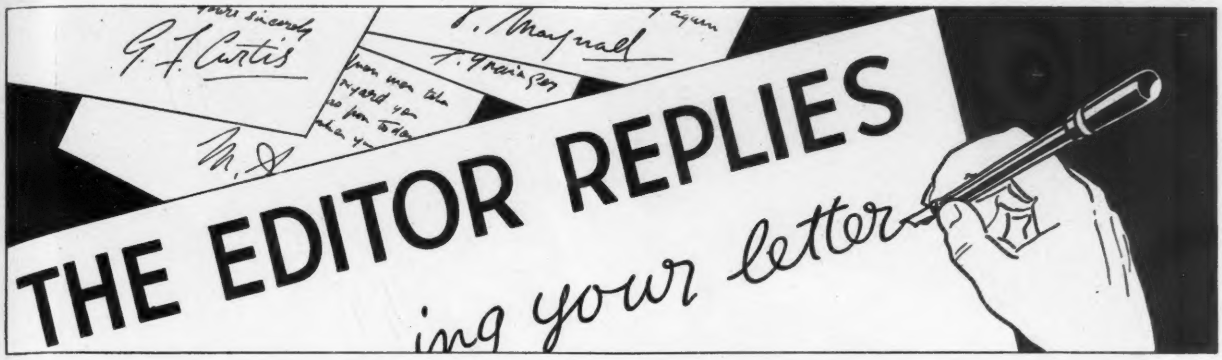
Lee, S. H. January 10, 1935.

This specification covers a lighting plant for coal mines or like places subject to explosive gas comprising electric discharge lamps of the cold-cathode, rare or inert gas type contained in flame-proof chambers and connected directly or indirectly to an insulated and armoured supply cable. Each chamber may be equipped with a transformer, but the transformer may be separated from the lamp-containing part of the chamber by a gas-tight partition.

No. 449,862. "Improvements in and Relating to Electric Arc Lamps."

The British Thomson-Houston Company, Limited. February 26, 1935, (*Convention, U.S.A.*).

According to this specification the envelope of a high pressure metal vapour arc lamp in which the electrodes are, in operation, vertically above one another, the upper electrode is located near the top and the lower electrode near the bottom of an envelope of which the diameter increases uniformly from bottom to top. The upper electrode is further from the top of the envelope than is the lower electrode from the bottom, preferably about three times as far. The construction of the lamp in this manner tends to secure evenness of temperature throughout the envelope and enables the lamp to be operated at relatively high temperature and high pressure even without the usual vacuum jacket.



Anything More You Would Like to Ask?

Getting a Job is always a harassing problem, though much easier now than a couple of years ago. We hear that some success has attended the efforts of the applicants who recently advertised in this journal. One of the most unsatisfactory features of the present position, however, is that situations can so rarely be found except with firms in the lighting industry.

This is all wrong. There **ought to be consulting engineers, Government Departments,** and large **concerns occupied with trading** and **public utilities,** who can utilise the services of experts on lighting, and it would be greatly to the benefit of the lighting industry if this were so.

We now understand that the term "**Alzak,**" about which we have received inquiries, is used in the States to denote a variety of special finish for reflectors, developed by the Aluminium Company of America. We are also now in a position to refer those interested to the owner of the licence for the patents concerned.

Mr. A. P. Trotter, in acknowledging congratulations on his golden wedding, reminds us of an early I.E.S. meeting when the possibility—as it seemed then a very remote possibility—of **direct reading photometers.**

These instruments have been developed much more quickly than would have seemed possible a few years ago. Though still far from perfect, they have manifest advantages in approaching consumers—who never could be induced to put faith in a measurement attained by "squinting down an eyepiece."

Our recent article on "**Calculations by the Lumen Method**" (Aug., p. 232), brings some comments from Mr. Howard Long. He remarks that, in determining the utilising factor, the height of the fittings is of minor importance, provided the size of the installation is reasonably large. Also that in many industrial installations the height and spacing of units are settled by the location of the plant, and cannot readily be adjusted to facilitate the use of standard sizes of lamps in order to get a certain illumination. He suggests that, if the illumination is reasonably liberal, a little alteration one way or another does not matter much; direction and quality of light are often of more consequence.

In regard to **depreciation,** Mr. Long declares that modern lighting fittings of glass and vitreous enamel should, if correctly maintained, be equally good after ten years' service. He infers that it is hardly expedient for the lighting industry to make so much fuss about conditions resulting from consumers' neglect. (It is true, however, that lamps, like human beings, show the effects of age—whatever fittings may do.) Our article was, perhaps, at fault in not making it clear that it is neglect by consumers rather than the nature of the fittings, that is chiefly responsible for deterioration. But it does not follow that the lighting industry should ignore this danger. This journal, which represents both the lighting industry and the consumer, feels it a duty to remind the latter of his duties, neglect of which may impair so greatly the work of the lighting expert.

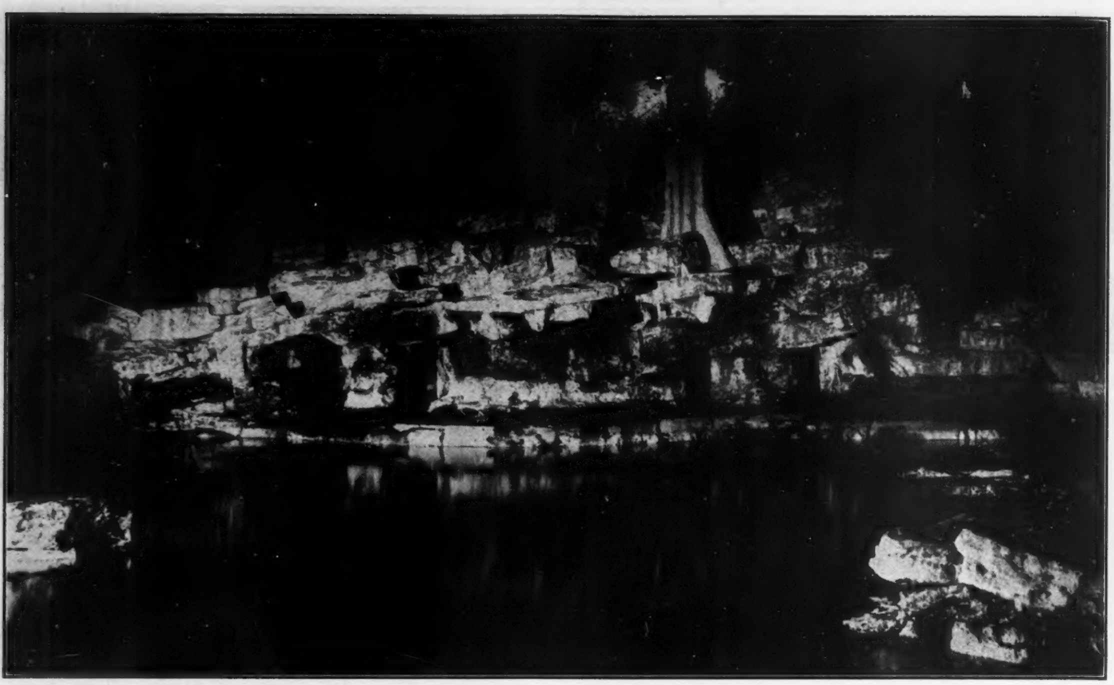
Our attention has been drawn to an article in the **Kinematograph Weekly** advocating the development of **Illuminating Engineering Laboratories** as an aid to **Cinema Work.** We have always believed that measurements of brightness (with due regard to actinic effect) ought to be helpful in the studio, for example, in preserving records of conditions of contrast that have worked well in certain cases. Perhaps some readers with more technical knowledge of cinema work could confirm this?

Mr. E. A. Hilton, writing from Chorlton-cum-Hardy, mentions that a **new cinema theatre** is in course of erection there. He also endorses what was said in our August issue (p. 238) in regard to the **auditorium.** He suggests that, with all our modern improvements, a really striking, new, and original type of film entertainment might be evolved, and asks why we should all continue to be herded in rows in darkness, instead of being seated comfortably at tables (with appropriate refreshment), and in subdued lighting, whilst the film is being shown. Why, indeed?

There has been some criticism, in philatelic circles, of the **lighting** of the famous Tapling **Collection of Postage Stamps** in the British Museum. The arrangement and lighting of stamps (and also of coins) is a job for the specialist. Intense illumination, combined with magnification, is often necessary, and some system of local lighting might seem to be indicated. One other consideration—which the museum authorities are not likely to overlook—is that the less such fragile things as postage stamps are illuminated, the better! Exposure to light hastens the fading of delicate colours. Very valuable specimens, therefore, ought not to be continuously lighted, but only illuminated whilst actually undergoing inspection.

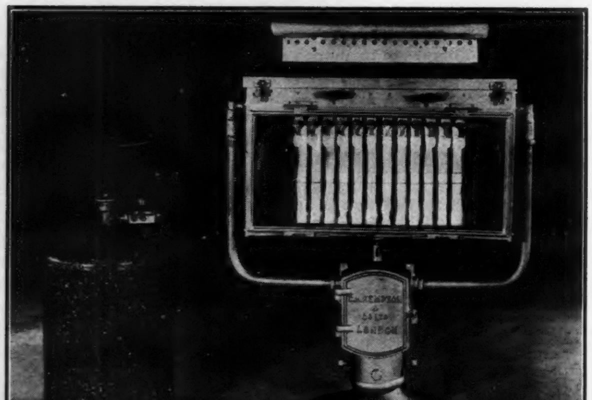
A correspondent, in commenting on the far-reaching organisation and attention to detail displayed in Germany during the holding of the **Olympic Games,** draws our attention to a campaign, having for its object the improvement of **lighting in all hotels** patronised by visitors. It was insisted, as a definite rule, that in all such cases lights both at the dressing-table and at the bedside should be provided (*O Si Sic Omnes!*)

Our recent adventure into astronomy has brought us on a reference to another phenomenon recorded in the daily Press—the so-called "**green flash**" **at sunset.** The sudden appearance of this green ray, an instant after the sun has sunk below the horizon, is said to be a very striking effect, rarely seen in the tropics, but almost unknown in our latitude. We ourselves have never seen it, and, after our experience in submitting the alleged flash at the culmination of the moon to experts, we forbear to press the claims of "the green flash at sunset." However, there it is. Some reader may have both experience and an explanation!



Floodlighting with Calor Gas at the Zoological Gardens

The above pleasing picture, illustrating the floodlighting of a scene at the Zoological Gardens (London) by means of the newly introduced Calor Gas, recently appeared in the "Gas Journal." The illumination was provided by a "Kempar" 12-light unit which is shown, together with the Calor Gas container, in the picture below. The distance



of the source of light from the rocks was fully 150 feet, and the arrangement was most effective considering that only a single lamp was employed.

The incident suggests that Calor Gas outfits are likely to prove very useful for floodlighting effects arranged at short notice and in positions where there is no gas or electricity available, or the leading of pipes and wires would be a difficulty. One can think of many situations—parks and gardens, illumination of objects on the shores of lakes and rivers, tunnels, railways, etc.—where portable self-contained outfits of this kind would prove an ideal solution.

Flashes

In a letter to "The Times" Mr. J. H. Sutcliffe, Registrar of the Joint Council of Qualified Opticians, remarks that one out of every three adults uses glasses. Eyestrain, due to inadequate lighting, is partly responsible. The lighting in the average home, he says, is only half as intense as it should be, and the bad lighting of streets imposes a visual strain of which every motorist is well aware.

* * *

Electric discharge lamps are about to be installed in over 200 miles of main traffic thoroughfares in Birmingham. Amongst other similar installations are those at Longbridge-road, Barking, in Southport, where a number of important roads have already been converted, and Eccles, where £1,604 is to be spent on a new scheme. Other installations of new electric lighting are projected at Peterhead and Sheffield, where the erection of 1,135 additional lamps at a cost of £4,634 is proposed.

* * *

In the main thoroughfares of Stratford-on-Avon, gas lamps of 3,000 c.p., each equipped with 12 mantles, have been installed on 25½ ft. concrete pillars, specially designed for the purpose. It is hoped to extend the system to all the principal streets in Stratford.

* * *

Improvements are now being carried out in accordance with the ten-year contract for gas-lighting entered into last January by the Northampton Borough Council. This affects about 2,760 lamps, and provides for the raising of about 300 lamps from 225 to 500 c.p., the addition of automatic control and an increase in the heights of lamps where necessary.

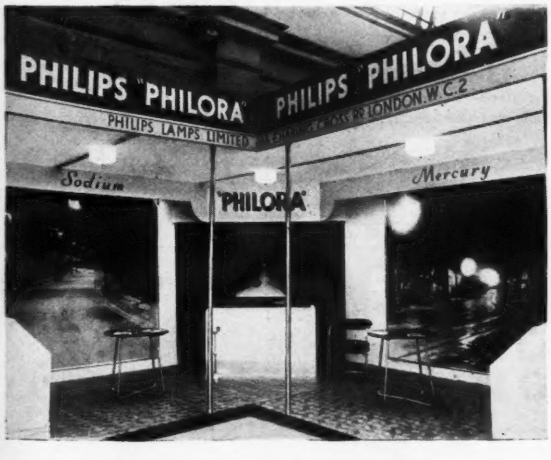
* * *

The report of the Lighting Engineer to the City of Liverpool mentions an increase of 31½ miles of electric street lighting. Many of these streets are lighted with sodium lamps, of which 153 are stated to be in use in the city.

* * *

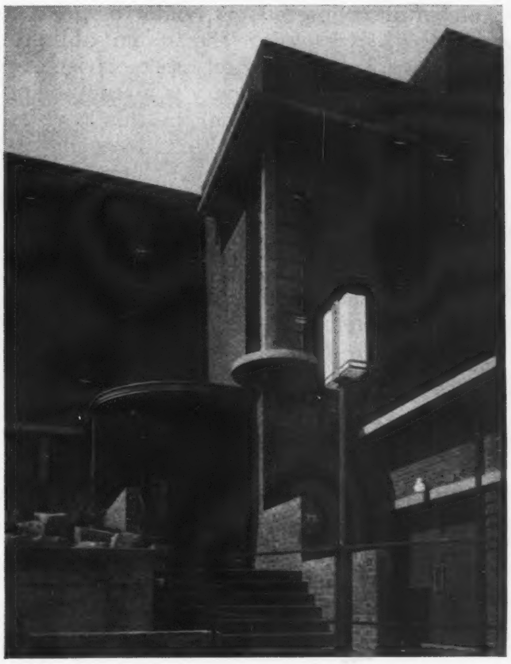
About 287 gas lamps are covered by a new street lighting contract for South Elmsall (Yorks); other recent contracts relate to Framlingham, Heckington, Haworth, Hanbury, Kingswood (Glos), Oxenhope, Clare, Ackworth, Wolverley, Cookley, and Normanton.

A Model Street Lighting Display



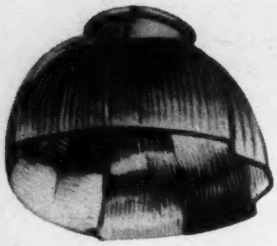
The above illustration of the Philips stall at the A.P.L.E. Conference at Cheltenham, is interesting as an example of the modern tendency at exhibitions to produce an arresting effect rather than to attempt an imitation of the catalogue by producing a mass of fittings. One side of the stall was devoted to mercury lighting with mercury vapour electric discharge lamps, the other to sodium vapour lamps. In each case a cunning attempt was made to produce a sense of perspective so that the observer had the impression of looking through a window at an actual lighted street. In the case of the sodium installation the effect was particularly striking.

Ryhope Colliery Pithead Baths



Colliery pithead baths may not seem very good objects for artistic treatment, but in the picture above modern design is aimed at, and the effect is not at all bad. In the foreground will be seen a fitting installed by Hailwood and Ackroyd, Ltd., of simple but effective design; a wall bracket and ceiling fitting, likewise furnished by them, are also visible. Pithead baths are now being widely installed at collieries. We hear that Hailware fittings are in great demand for this type of building.

Curtis X-Ray Reflectors



The Curtis Lighting Company of Great Britain, Ltd., have developed a range of equipment for street lighting which has many unique features. The system consists of a series of silvered glass X-Ray reflectors in sizes from 60 to 1,000 watts, which are designed to provide various forms of light distribution. The lanterns are of heavy gauge copper of pleasing design, and the type of reflector required to suit the light requirements can be quickly fitted to the standard lantern.

The 60/1,000 watt units consist of a one-piece glass globe, the upper part of which is silvered. When attached to the simple copper housing the fitting is dust- and weather- proof. Two of these unusual X-Ray reflectors are illustrated.

The new Holophane Bi Way Refractor, a unit of pleasing design and with varied applications.

Glass Bricks at Olympia

A novelty of outstanding interest, shown by Pilkington Bros., Ltd., at the recent Building Exhibition, Olympia, was the "insulight" glass brick, which serves as an insulation against sound but transmits diffused light. The glass brick is hollow, and the internal space is a partial vacuum. It has great hygienic merits, as the surface is non-porous and incapable of absorbing odours, water or grease, or of transmitting air or gases. The amount of light transmitted by various patterns of bricks varies from 73.4 to 84 per cent. Glass masonry is already being used in America. Its development in this country is of outstanding interest to the illuminating engineer.

Another recent Pilkington development is a form of toughened glass, available in a range of twelve tints, which has excellent heat-resisting qualities and is believed to have considerable advantages for floodlighting and stage lighting.

Contracts Closed

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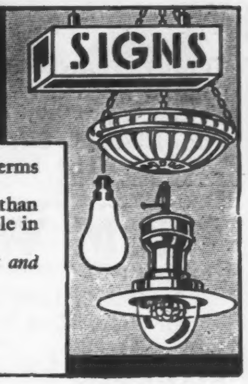

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FOR STREET LIGHTING
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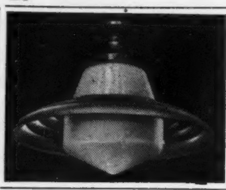

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Index to "Where to Buy"

N.B.—The numbers are those attached to individual entries in the Directory *(See pp. 329-332.)*

Catalogues and Advertising Literature

We invite all firms in the Lighting Industry to send us new catalogues as they appear, for reference in these columns.

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WE have pleasure in announcing to our readers that we have entered into an arrangement to receive subscriptions for the French Journal "Lux" (La Revue de l'Eclairage). The subscription per annum is 30 francs, the approximate equivalent of which in English money is Seven Shillings and Sixpence (7/6).

"Lux" is the only French journal which specialises in all aspects of lighting; it is the official organ of the Association Française des Ingenieurs de l'Eclairage (equivalent to the Illuminating Engineering Society in France).

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